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THE BULLETIN OF
THE GEOGRAPHICAL SOCIETY
OF PHILADELPHIA

VOLUME VII

JANUARY-OCTOBER, 1909

Published Quarterly by the
GEOGRAPHICAL SOCIETY OF PHILADELPHIA
1909

RECLAIMING THE DESERT.

C. J. Blanchard,

Statistician, United States Reclamation Service.

The passage of the Reclamation Act on June 17, 1902, launched the government on a work of internal expansion of vast magnitude and of tremendous importance to the entire nation. In many of its provisions this law is unique, differing wholly in concept from any other congressional statute.

It provides for a reclamation fund consisting of the proceeds from the sales of public lands in the 16 arid and semi-arid states and territories; for a Reclamation Service to investigate and report on the irrigation projects for the approval of the Secretary of the Interior, who may authorize construction and let contracts, providing money is available in the fund; for the return to the fund of the actual cost of each project by the sale of water rights, payments to be made in a series of instalments in ten years, without interest. The lands are disposed of to bona fide settlers only, and the works will be turned over to the people when their cost has been returned to the government.

The total fund available for this work to the end of the present fiscal year amounts to $50,790,740.15, the increment to the fund for the fiscal year ending June 30, 1908, being approximately $9,563,373.57.

The plans thus far approved by the Secretary of the Interior provide for the reclamation of more than 3,000,000 acres of land. It will be several years, however, before these projects are entirely completed.

Already the Reclamation Service has water available for nearly a million acres of land, and the settlers who have taken up farms on a considerable portion of this area are returning to the treasury in small amounts a part of the investment of the government.

Nevada: The first work to be undertaken under the Reclamation Act was the Truckee-Carson project in Nevada, and on June

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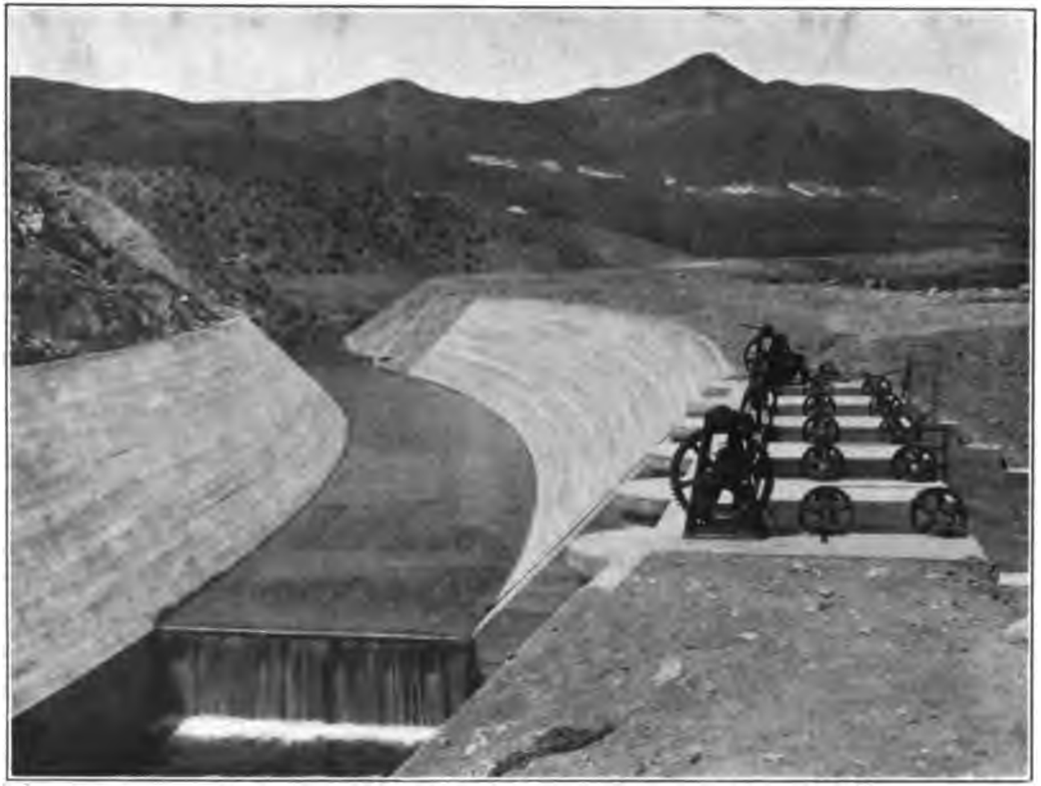
17, 1905, the third anniversary of the passage of the law, the first unit was formally opened to the public. The principal engineering features of this project consist of a canal 31 miles long to carry the waters of the Truckee River over into the Carson Valley where they are used for irrigation; extensive storage works in the foothills of the Sierra Nevadas, and the complete utilization of the four principal rivers of the state. When complete this system will render productive about 400,000 acres of land. Water is now available for approximately 100,000 acres. About 400 farms are now awaiting settlers here. The terms are easy and the market for farm produce one of the best in the country. The valley is reached by the Southern Pacific Railroad.

Arizona, Salt River Project: In the order of magnitude and prominence of its engineering features the Salt River project ranks first. It involves the construction of the Roosevelt dam, one of the highest structures of its kind in the world, which will rise 284 feet above the lowest foundation. It will be 1,080 feet long on top and its foundation covers about one acre of ground. The dam is located in a narrow canyon of the Salt River just below the mouth of Tonto Creek. It will create a reservoir having a capacity of 1,284,000 acre feet, or sufficient water to cover that many acres one foot in depth. Forty miles below this dam the water is diverted by means of a low dam, known as the Granite Reef diversion, into the main canals, one on each side of the river. The lands under this project surround Phœnix, the capital of the territory. They have a general elevation of from 1,000 to 1,300 feet above sea level, and the temperature ranges from 20 to 120 degrees. The valley is traversed by the Southern Pacific and Santa Fe Railroads, which connect it with the Pacific coast cities and eastern markets. A power canal 19 miles long, having a capacity of 220 second feet, is now being used to develop power to run the plants incidental to the work of construction. When the Roosevelt dam is completed several thousand horse power will be developed and utilized to pump water from underground sources to supplement the surface supply and increase the irrigable acreage. A cement mill erected and operated by the government is furnishing the cement used in construction work.

Arizona-California, Yuma Project: The engineering works in-



WASTEWAY OF TRUCKEE MAIN CANAL. TRUCKEE-CARSON PROJECT, NEVADA.

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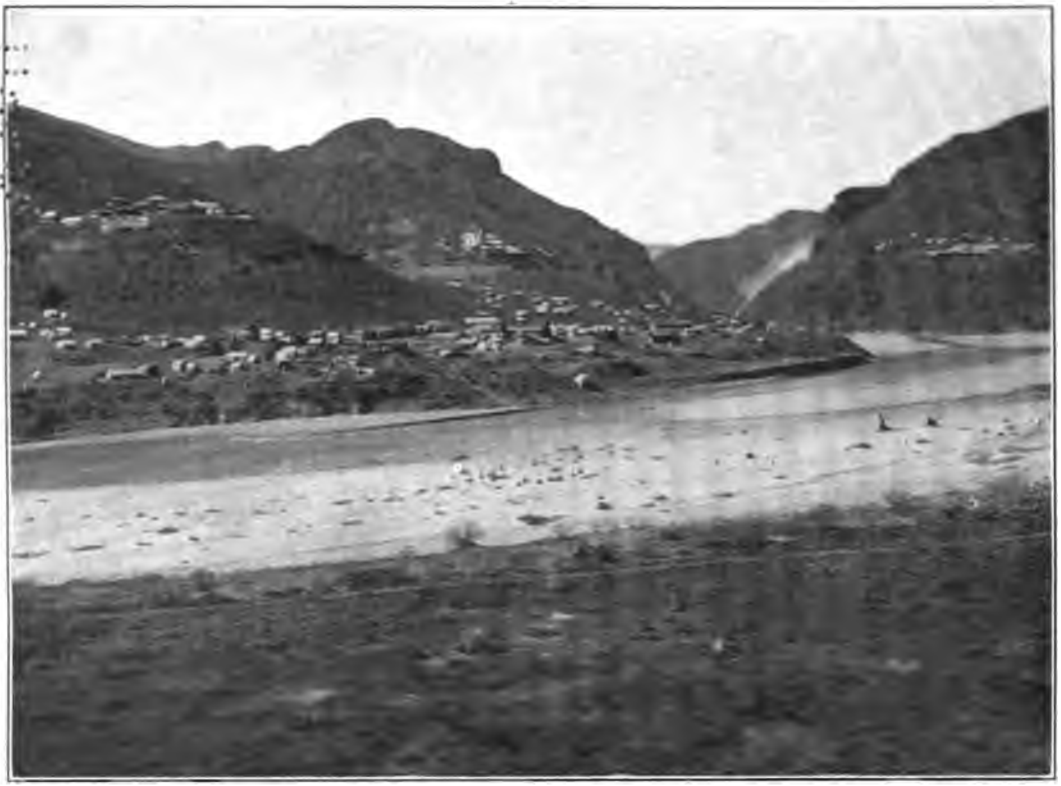


ROOSEVELT DAM SITE, LOOKING DOWN STREAM. Temporary town of Roosevelt, which will be submerged when the reservoir fills, is on the lower bench.

volved in this project are unusual and unique on account of the difficult physical conditions and the immense flood discharge of the Colorado and Yuma rivers. The engineers were unable to find solid bed rock upon which to rest a dam, and the work was further complicated by the fact that large areas of bottom land are annually inundated, and that the Colorado River carrys an enormous amount of silt. These conditions necessitated the construction of a dam of a type never before used in this country, and the building of many miles of levees to protect the lower lands from floods. The Laguna dam is of the India Weir type which has been successfully operated in India and Egypt for more than half a century. It consists of three concrete core walls resting on sheet piling, the space between the walls filled with broken stone and capped with concrete paving 18 inches thick. The dam is 4,800 feet long, 19 feet high, and 226 feet wide up and down stream. Its weight is about 600,000 tons. It is expected that this structure will be completed early in March. It will back the water up stream for about ten miles, forming a settling basin. The headgates of the main canals, which are taken out of the sides of giant sluiceways on either end of the dam are so arranged that only the top foot of water is drawn off, the surface water being comparatively free from silt. The levees have an aggregate length of 75 miles, and are considered the most perfect dikes ever constructed. At the base they are several times as wide as their height, and their tops are four feet above the highest known floods.

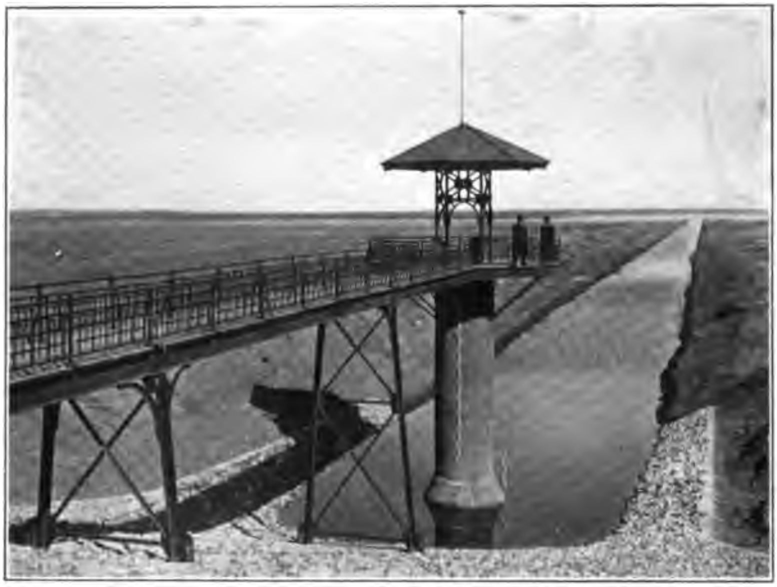
A portion of the waters of the main canal on the California side will be carried under the Colorado River by a siphon, and used for the irrigation of land near Yuma. It is expected that considerable power will be developed here which will be used to pump water to the mesa lands. The Farmers pump and the big scoop wheel are already furnishing water to several thousand acres of bottom land below Yuma. It is expected that 17,000 acres on the Indian reservation wil be thrown open to entry early in the fall.

California, Orland Project: This project involves the reclamation of 12,000 acres of land lying about 90 miles north of Sacramento in Glenn and Tehama counties. The only town within the territory to be irrigated is Orland, on the Southern Pacific Railroad. The lands are exceedingly fertile, and for many years have been cultivated and utilized for wheat growing. With irrigation and the prevailing climatic conditions, however, it has been demonstrated that the land is unequalled for the production of alfalfa, nuts, and both citrus and deciduous fruits.

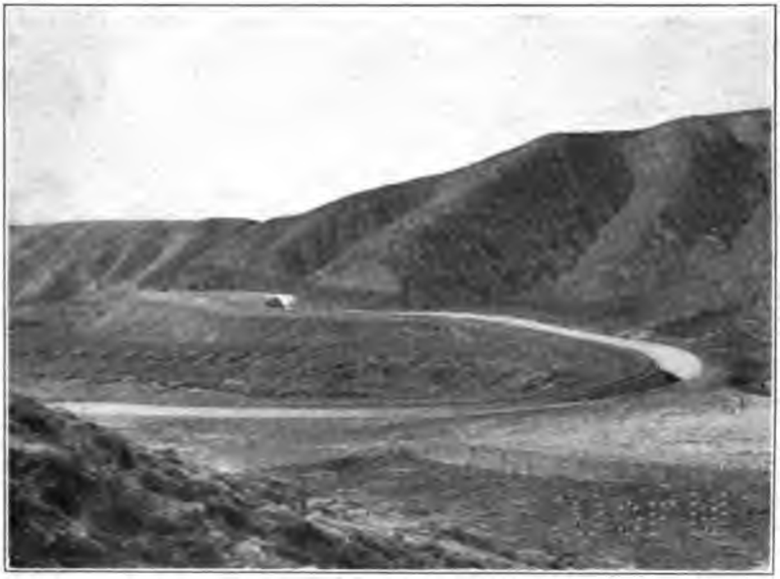
Colorado, Uncompahgre Project: One of the most spectacular pieces of engineering ever attempted in the West is involved in the construction of the Uncompahgre project in western Colorado. The initiation of this work took place only after engineering ingenuity had been taxed to its utmost in the completion of surveys and plans of structures. The plans involve a tunnel approximately six miles long, with a cross section of 10½ by 11½ feet, passing for the greater part of its length 2,000 feet below the surface of Vernal Mesa. This tunnel will carry the waters of the Gunnison River into the Uncompahgre Valley to supplement the insufficient flow of the Uncompahgre River and furnish a permanent water supply for more than 150,000 acres of exceedingly fertile land. Considerably more than five miles of this tunnel have been excavated and it is expected that some water can be turned through it before the close of the coming season. About 60,000 acres of the land under this project are suitable for the growing of first class peaches and apples, while the bottom lands, comprising from 80,000 to 90,000 acres are better adapted to the growing of alfalfa and sugar beets.

Colorado, Grand Valley Project: This project is planned to irrigate about 60,000 acres of land in Grand Valley, in the extreme western part of the state. The work involves the construction of a diversion dam in Grand River, 55 miles of canal, and a series of short tunnels on the first few miles of the canal. It is probable that considerable power will be developed at drops in the canal, and in that event the irrigable area can be extended considerably. The preliminary investigations have been completed but actual construction work has not yet commenced.

Idaho, Minidoka Project: This project provides for the reclamation of about 130,000 acres of land on both sides of Snake River in southern Idaho. The principal engineering feature is a rock-fill dam located about 8 miles southwest of Minidoka, Idaho. This structure is 625 feet long, 80 feet high, and 25 feet wide on top. It was completed in September, 1906. About 70,000 acres were



Outlook Tower, Hondo Reservoir, New Mexico.



Main South Canal, Uncompahgre Valley. Lined canal section through clay foothills.

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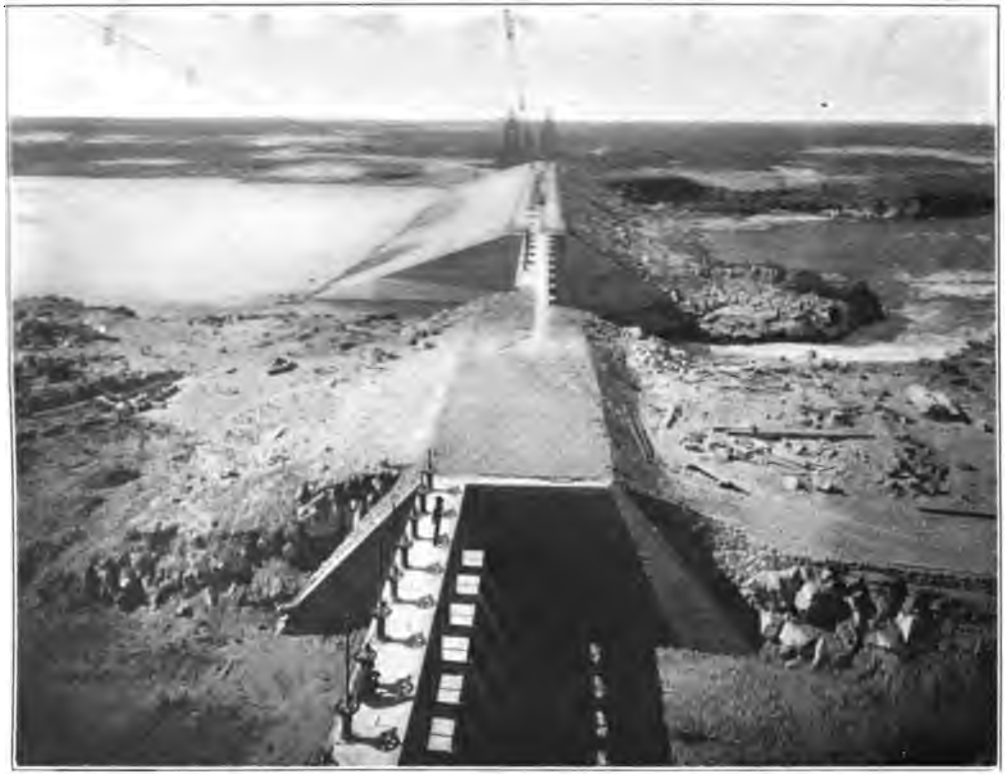

Minidoka Dam on the Snake River. Power units to develop about 10,000 horse power will be installed in the bays of the main dam.

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irrigated in 1908, and this acreage will be increased to 110,000 during the present year. The natural conditions at the dam site are favorable for the development of power, and a pumping plant has already been installed to furnish water for lands too high to be reached by gravity ditches.

Idaho, Payette-Boise Project: This project is located in the valley of the Boise River, with the thriving little city of Nampa about the central point. It provides for the reclamation of 372,000 acres, or twice the cultivated area of Rhode Island. The section is noted for its fine climate, and for the wide variety and large yields of its products. The works involve no difficult engineering features, the plans providing for storage on the Payette and Boise rivers, and the diversion of the surplus water of the former into the valley of the latter by means of a large canal cut through the hills which separate the streams. Water will be available for about 170,000 acres during 1908, but the system will not be entirely completed for several years.

Oregon, Umatilla Project: This project is located 190 miles east of Portland, and contains 20,000 acres of land bordering upon the Columbia River, immediately east of Umatilla River. Water is now available for 7,000 acres of this land. The land is suited for orchards and gardens, and from 10 to 20 acres are considered ample for the support of a family. The climate is warm, the elevation only 500 feet above sea level, and fruits and vegetables raised here are among the earliest on the market. The transportation facilities are excellent, the markets being the large cities of Portland and Spokane.

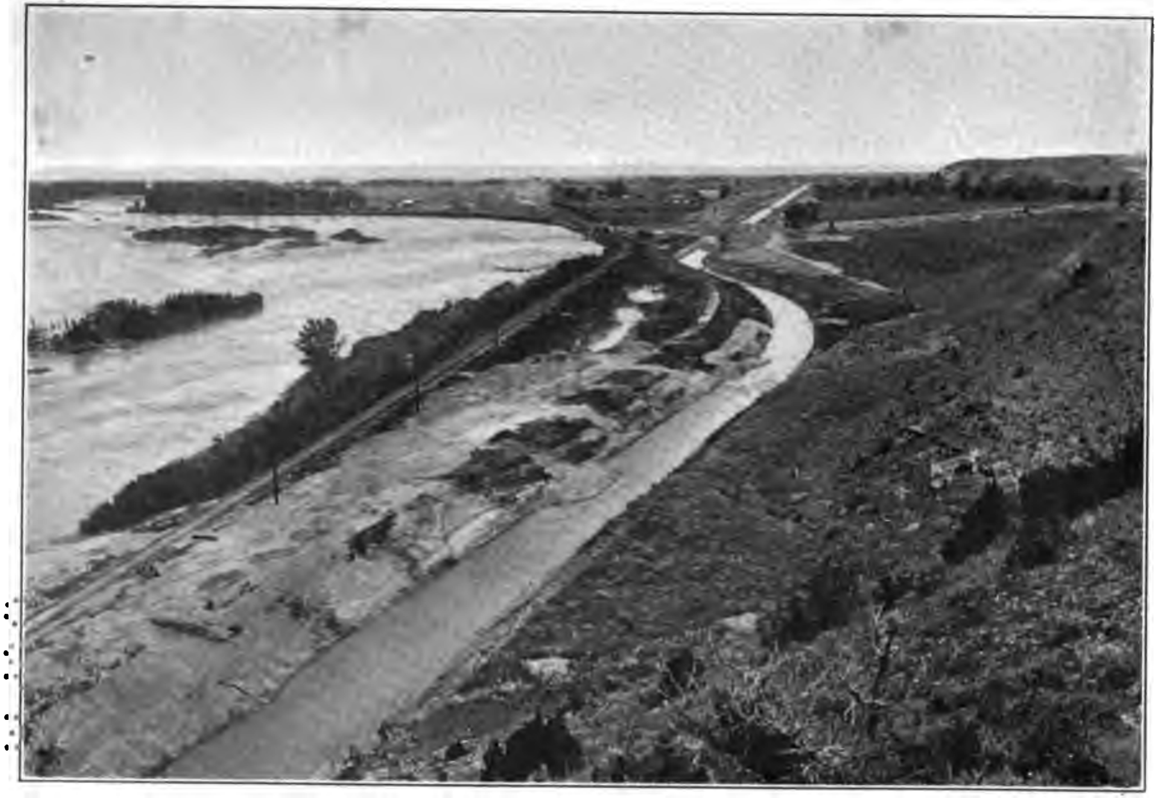
Oregon-California, Klamath Project: The plans for this project involve irrigation and drainage in peculiar combination. In addition to the irrigation of the valley lands a portion of Lower Klamath and Tule lakes, which are now either swamp lands or lake bottom, will be drained and then irrigated. Practically all the uplands, which include the greater part of the project, are held in private ownership, a large part being in holdings which, under the terms of the Reclamation Act, must be subdivided into tracts of not to exceed 160 acres. The public lands under this project, which include a large portion of the lake and swamp areas, are at present withdrawn from entry. Water will be available for about 30,000 acres this year, but the project in its entirety will reclaim about 190,000 acres.

Kansas, Garden City Project: The first project of the Government which involved pumping was at Garden City, Kansas. The plant is designed for the recovery of underground waters, which are delivered to an old canal known as The Farmers' Ditch. It consists of twenty-three separate pumping stations, each driven electrically from a central power station located on the main line of the Atchison, Topeka and Santa Fe Railroad at Deerfield, Kansas. The project includes about 10,000 acres of rich, prairie loam, well adapted to the raising of small grains, sugar beets, cantaloupes, alfalfa and other crops of western Kansas.

Montana, Huntley Project: Located in the ceded strip of the Crow Indian Reservation in southern Montana, is the Huntley project, which includes 30,000 acres of exceptionally fine land. The Northern Pacific and the Chicago, Burlington and Quincy railroads traverse the tract and afford the best of transportation facilities, no farm in the project being more than 2½ miles from a shipping point. The general elevation is 3,000 feet above sea level, the climate is delightful and the soil produces abundant crops when properly watered. A fine free range country surrounds the project which makes stock raising profitable when winter feed can be had.

Montana, Sun River Project: The lands under this project are located west of the center of Montana, on the eastern slope of the Rocky Mountains, and near Great Falls, one of the largest cities in the state. The Sun River Valley is about 70 miles long, from one to five miles wide, and a large part of it is already in cultivation. The ultimate development of this project involves the reclamation of 256,000 acres of land. A compact body of 17,000 acres, known as the Fort Shaw unit, is now open to settlement under the homestead law and the farms are being rapidly taken up.

Nebraska-Wyoming, North Platte Project: This project is located about 100 miles north of Cheyenne, Wyoming, and extends along the North Platte River for nearly 500 miles. It will supply water to about 200,000 acres in Wyoming and 200,000 acres in Nebraska when completed. The principal engineering features consist of a dam known as the Pathfinder, near Caspar, Wyoming, a low diversion dam located about 150 miles down the river, and an



Huntley Canal, looking East. Town of Huntley in the distance.

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interstate canal 140 miles long. The dam will be completed during the present year. It is the third highest dam in the world, and its completion will not only regulate the flow of the river for irrigation purposes but will prevent forever the disastrous floods which annually destroy millions of dollars worth of property in the valleys below.

North Dakota, Williston Project: This is one of the unique projects of the Reclamation Service The Missouri River has a habit of constantly cutting its banks and changing its channel, so that it would be impossible to locate any structure for the diversion of water unless enormous expense were incurred to protect it from the scour of the stream; moreover its grade is so flat that any gravity canal would be of prohibitive length. Fortunately large beds of lignite were discovered in the vicinity, affording cheap fuel, and the engineers conceived the plan of building a power house at the coal mines and conveying the power by electric conduits to the river. The pumps are located on floating barges which accommodate themselves to changes in the channel and in the water level. The water is delivered through pipes with flexible joints into basins located at sufficient distance from the shore to be safe from encroachment by the shifting river. From these settling basins the water is pumped into canals to cover the irrigable lands. Water was available for about 7,000 acres of bench and valley lands surrounding Williston in 1908.

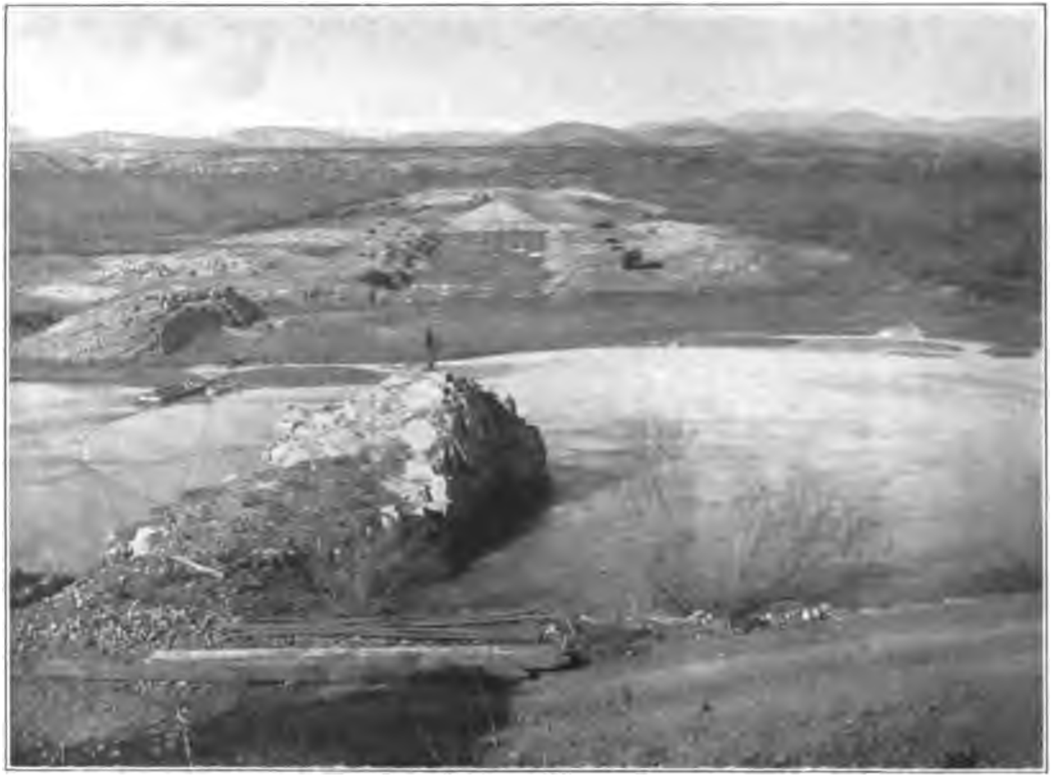
Buford-Trenton Project: This project is located on the north bank of Missouri River, near the Montana state line. The first unit of this project is completed and covers about 12,000 acres. The power for pumping is transmitted electrically from the main generating plant at Williston.

North Dakota-Montana, Lower Yellowstone Project: This project provides for the diversion of the Yellowstone River at a point 18 miles northeast of Glendive, Montana, for the irrigation of 66,000 acres of land. The work has reached a point where water is available for 45,000 acres of land. Two thirds of this area is in Montana, and the balance in North Dakota. It is tributary to the main lines of the Northern Pacific and Great Northern railroads. Surrounding the project is one of the largest and best grazing areas in the United States, providing a fine free range for vast numbers of cattle and sheep. There is an abundance of fuel in the shape of lignite, which is found all over this section.

South Dakota, Belle Fourche Project: This project involves the construction of one of the largest earth dams in the world, a structure over a mile long, 115 feet high, and 20 feet wide at top. This dam is built in a depression between two hills and will create a reservoir with a water surface of about 9,000 acres. A concrete diversion dam diverts the entire flow of the Belle Fourche River into an inlet canal 6½ miles long, which carries it to the reservoir. The earthen dam is not yet completed, but the canal system delivered water to about 12,000 acres during 1908. The irrigable area will be increased to 30,000 acres this year, and it is expected that the system will be practically completed in 1910. About 100,000 acres will be reclaimed by the completed project.

New Mexico, Rio Grande Project: This project will provide water for the irrigation of about 180,000 acres of the rich valley lands along the Rio Grande in New Mexico, Texas and Mexico. The principal engineering work involved is the Engle dam, to be built of cyclopean concrete, arched upstream, and 265 feet high. This structure will close the Rio Grande near Engle, New Mexico, forming a reservoir 45 miles long and 200 feet deep at its lower end, with a storage capacity of over 2,000,000 acre-feet. The Leasburg Diversion, which is a part of the Rio Grande project, and the first unit to be constructed, consists of a low 600-foot concrete diversion dam, with pier, embankment and sluicegates, head weir and headgates. In connection with the diversion dam six miles of canal were constructed to connect with the old Las Cruces canal. This work was completed in March, 1908. It furnishes water to about 20,000 acres. Work has commenced at the Engle dam site and will be carried on as rapidly as the state of the reclamation fund will permit.

Carlsbad Project: The principal work on this project was the reconstruction of canals and reservoirs on the Pecos River in Eddy county, which were built by private enterprise, to irrigate about 20,000 acres of land. This project is completed. Several thousand acres are included in excess holdings, and must be disposed of to farmers who will purchase water right under the government system.



Site of the Leasburg Diversion Dam on Rio Grande. Canal gates will be set in Penasco Rock in the foreground. Concrete dam will extend from Penasco Rock to join embankment in the distance.

Hondo Project: This project provides for diversion and storage of the flood waters from Hondo River, a tributary of the Pecos, to irrigate 10,000 acres of land in the vicinity of Roswell. Lands in private ownership are for sale at reasonable prices. The Pecos Valley and Northwestern Division of the Santa Fe Railroad has a line into Roswell.

Utah, Strawberry Valley Project: About 40,000 acres of land in central Utah, situated from 5 to 15 miles south of Provo, will be irrigated by this project. The water supply will be received from a storage reservoir to be built on Strawberry River, about 30 miles east of the irrigable area. By means of a tunnel four miles long the stored waters will be carried through the mountains and emptied into Spanish Fork, from which a canal from 18 to 20 miles long will convey them to the irrigable area. This work is now well under way.

Washington, Okanogan Project: This project is designed to supply water to 8,650 acres of land in Okanogan Valley in northern Washington. The land is very fertile, and owing to the exceptionally favorable climate a wide variety of products, many of which are high priced, are grown. Lumber for building purposes and fuel supplies are practically unlimited. The lands are tributary to the Great Northern Railroad.

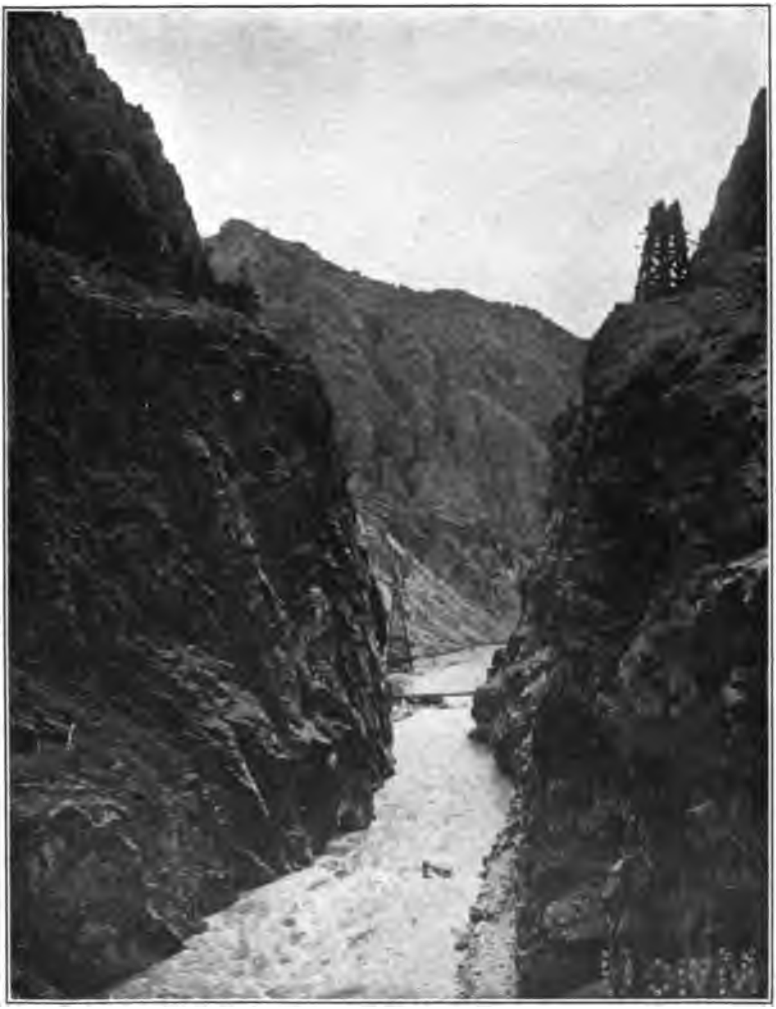
Yakima Valley Projects: Yakima Valley contains an area of approximately 500,000 acres; with storage it is estimated that the water supply is sufficient for 340,000 acres, including approximately 100,000 acres in the Yakima Indian Reservation. The development of the valley will be accomplished by the successive construction of several units of a general project, the work being gradually extended to embrace the entire irrigable area.

The Sunnyside division consists of the enlargement and extension of an existing system known as the Sunnyside Canal system, which was purchased by the Government. The work is going on rapidly and when completed the system will irrigate 86,000 acres, of which 40,000 acres are now supplied through the old canal system.

The Tieton division embraces an area of about 24,000 acres near the city of North Yakima. The water supply will be from Tieton River supplemented by water stored in Bumping Lake.

Storage is being provided for the Yakima Valley projects by erecting dams at the outlets of several mountain lakes, the capacity of which total 804,000 acre-feet. Only the preliminary surveys have been made on the Wapato and Kittitas divisions.

Wyoming, Shoshone Project: This project involves the diversion of a portion of the surplus waters of Shoshone River and the construction of an impounding dam at the head of the canyon through which the river flows. The reservoir thus created will have a storage capacity of 456,000 acre-feet. When the project is completed it will be possible to reclaim about 150,000 acres of land. The principal engineering feature is the Shoshone dam, a concrete masonary arch, and the highest structure of its kind in the world. This dam will lock a very narrow canyon, so that in cubical contents it will not compare with any of several other dams, but in its great height it exceeds them all. From bed rock to top it will be 328.4 feet high; at its base it is only 85 feet long, and on top only 200 feet. As in Arizona it was necessary to construct a road up the canyon for several miles. Water was available for 15,000 acres, a large portion of which has already been filed upon, and preparations are being made to open the second unit.



Site of the Shoshone Dam, Wyoming, looking up stream. It will be the highest dam in the world; height from foundation to coping 310 feet.

THE NATIONAL FORESTS FROM AN ECONOMIC STANDPOINT.

TREADWELL CLEVELAND, JR.,
UNITED STATES FOREST SERVICE.

The national forests possess economic utility for two reasons—they contain natural resources, and the use of these resources is regulated. If the land in the forests had never been set aside for forest use, the resources, while they lasted, would still have had economic value. The purpose of this paper is to show how this value is affected by the existence of the forests.

The first step is to consider the resources themselves.

WHAT THE FOREST RESOURCES ARE.

The major resources within the national forests comprise minerals, agricultural lands, timber, water, and forage. Of these, the minerals are not the subject of special forest regulations. Mining, however, is largely dependent upon timber, so that the mines are by no means independent of the forest regulations governing the use of timber. The agricultural lands are open to entry under the homestead laws as modified by the Act of June 11, 1906, which facilitates settlement within the forests, and are as easily available as the agricultural lands outside the forest boundaries, except where, in a few cases including altogether only an inconsiderable area, they are required for administrative use in connection with forest business. However, agricultural settlement within national forests has certain marked economic advantages. The settlers share in the benefits of the protection given to the adjacent forests, while the permanent improvements hasten the development of the country and promote ease of intercourse. Of the major resources, there are left, for chief consideration in this paper, the timber, the water, and the range, all of which are used subject to forest regulations.

WHAT MAKES THEM VALUABLE.

To estimate the capital value of the forest resources is exceedingly difficult. The following estimate was, however, submitted by the Forester to the Agricultural Committee of Congress in 1906.

1. Stumpage value of 330 billion feet of timber at $2 per M.	$660,000,000
2. 110 million acres capable of producing commercial forest at $1 per acre	110,000,000
3. 110 million acres of range for grazing live stock, at 1½ cents per acre (capitalized at 5 per cent.)	30,000,000
4. 83 million acre-feet of water for irrigation purposes, at 10 cents per acre-foot (capitalized at 5 per cent.)	166,000,000
5. Three million horsepower, capable of being developed from water in forests, at $10 per horsepower (capitalized at 5 per cent.)	600,000,000
6. Estimated value of occupancy and use of forest land, products and resources additional to the above	5,000,000
7. Permanent improvements now on the forests (roads, trails, cabins, telephones, etc.)	5,000,000
Total	$1,576,000,000
Less 10 per cent. for private holdings	157,600,000
	$1,418,400,000

The gross area of the national forests has since been increased about 50 per cent., and is now nearly 168,000,000 acres. Assuming a proportionate increase in the value of each of the seven items in the former estimate, and allowing for the fact that of the present gross area 12.5 per cent. is in private holdings, the present capitalized value of the forests is $2,106,000,000.

Now, the important thing to remember about this statement is that, supposing it to be exact, it would be meaningless were it not for the fact that the use of the resources is now regulated. These great resources have this value because they are perpetuated. Unregulated use would be equivalent to spending capital instead of income, and would end in bankruptcy. This is made very clear when we analyze the economic value of natural resources in general. The factors of value in natural resources are: (1) Intrinsic value, or quality adapting it for use; (2) location, with respect to place of use and ease of access; (3) present and prospective supply, and (4) production cost. The last factor—production cost—is not a simple factor, but depends partly upon intrinsic value, location and supply, as well as upon physical or chemical composition. Thus the three primary factors of value in natural resources are: Intrinsic value, location, and supply.

Intrinsic Value.—The major forest resources—timber, water, forage—belong to the class of renewable resources. Use does not necessarily exhaust them. It is evident that in the case of a renewable resource there does not exist the same cogent incentive to seek substitutes that exists in the case of resources which can not be renewed, since the obvious way of avoiding shortage is by means of economy and perpetuation. At any rate, no true substitute for any of these resources is known. So-called substitutes for wood, whether as fuel or in construction and manufacture, must be regarded as supplements rather than true substitutes, for they do not greatly affect the increasing wood consumption. A substitute for water is probably unthinkable, and a substitute for the forest forage crop would involve excessively costly readjustments in the live stock industry now dependent upon it for summer range. These three resources possess qualities which peculiarly adapt them for human wants; they possess high, and probably permanent, intrinsic value.

Location.—The physiographic and climatic features of the western country lend these resources special value for the regions in which they lie. Development depends upon them. The timber constitutes the only supply which will be left when the adjacent private holdings, over-cut by drastic lumbering and wasted by fire, are stripped and left unproductive. The forage makes the local stock-raising industry what it is. Above all, the water is the life of the lowlands it supplies. This resource would have to be safeguarded even if the forests were to be the price. Fortunately, however, almost universally throughout the forests, water and forest conservation can be secured only together, since the forests alone make the water dependable.

Supply.—Though the supply of these resources immediately available is limited, yet in the long run, under methods of use which perpetuate them, their total product will be incalculable. Let us not forget that these resources all belong to the renewable class. If, however, they were left open to random use, their great intrinsic value, combined with their convenient location and, except for part of the timber, their accessibility, would furnish an irresistible invitation to enterprise, and their renewability would be ignored in the rush for instant profits. Used *ad libitum* for all they were worth, they would be quickly consumed in a riot of exploitation, or, held and monopolized in order to force prices, they would place in the hands of the adventurous and adroit a powerful weapon of economic oppression. The results of such a course would menace the development of the entire western country.

How Regulation Works.

The present national forest policy of development through wise use is the result of growth. This growth has had three stages, of which the first ended in 1897 and the second in 1905. We are now in the third stage. The significance of the changes may be effectively traced in the modification of the policy affecting timber sales, and these are accordingly outlined.

The First Stage.—The so-called "Timber and Stone Act" of June 3, 1878, was the first law to recognize the fact that standing timber has a value in itself apart from the land on which it grows, and that the government has the right to sell the land or its timber. Under this law tracts not exceeding 160 acres may be purchased for $2.50 per acre, without cultivation of the land or residence on it, provided the applicant testifies that the land contains no precious minerals and is more valuable for its timber or stone than for any other purpose. This law is still in force with respect to the timber on the public domain outside the national forests. Not far from 12 million acres of forest land have been disposed of in this way at a price much below the value of timber alone.

Another act of the same date deals with mining land, and permits the cutting and removal of timber for building, agricultural, mining, or domestic purposes from such land, within several of the public land states and territories. Though the Commissioner of the General Land Office issued a circular of instructions to cover the cutting of timber under this act, it was impossible to enforce these regulations, which were intended to provide for a future timber supply. As a result, where advantage was taken of the act, the forest was converted into waste land.

The acts of March 3, 1891, and February 13, 1893, permit the free removal of timber from unoccupied, unreserved, non-mineral public land, for fire wood, fencing, building, or other agricultural, mining, manufacturing, or domestic purposes, but not for sale or disposal. The amount of timber that can be taken by a single applicant under these acts, which still apply to timber land outside the national forests, must not exceed a stumpage value of $50 in any one year.

The Homestead law, of May 20, 1862, which has proved so beneficial as an incentive to settlement, is nevertheless responsible for the greater part of the waste of timber on the public domain. The Commutation Clause of this act, which gives absolute title to government land after an actual residence of eight months, and upon a cash payment of $1.25 per acre, was used to obtain patent to lands which were afterwards turned over to corporations and large lumber companies. Thousands of acres thus obtained have since been cut over and abandoned.

An Act of June 4, 1897, which enabled persons and companies who had holdings that were afterwards included in national forests to exchange these holdings, no matter how worthless, for valuable timber lands outside the forests, without charge, resulted in the abandonment of much waste land and the cutting of a vast amount of valuable timber without provision for the future. This law, known as the lieu selection law, has since been repealed, March 3, 1905.

The Second Stage.—The Act of June 4, 1897, providing for the control and administration of the national forests and authorizing the Secretary of the Interior to sell timber from them, marks the turning point of the timber sale policy of the government. The establishment of the national forests had been provided for by the act of March 3, 1891, but this act had carried no appropriation for the care and protection of the forests. The later law made it possible for the first time to dispose of the timber in the forests, to which the foregoing laws dealing with timber on the public lands did not apply. No timber could, however, be exported from the state or territory in which the forest was located. Rules were made by the Secretary of the Interior to regulate cutting, and though these rules were largely ineffective for lack of technical men to frame them and of rangers to enforce them, the forests were left in far better condition after timber sales than were the public lands outside the forests.

On the whole, however, the tendency of the policy during this period was to preserve the forests almost exclusively for future use rather than to develop their present usefulness at the same time. Trespassers, who regarded the trespass penalties as merely a part of the business transaction of securing wood, cut during this period five times as much wood as was sold, and from June 4, 1897, to June 30, 1904, the total receipts from timber sales was only $203,245.87.

The Third Stage.—The third period in the timber sale policy opened with the transfer of the administration of the national forests to the Secretary of Agriculture, February 1, 1905. In brief, the present policy is as follows:

" The sale of dead timber is everywhere encouraged, live timber is sold, except where its removal would make a second crop doubtful or would reduce the supply so that there would be danger of not meeting local demands, or where injury to streams might follow. With a few exceptions the timber may be exported from the state or territory in which it is cut. In order to give as much publicity as possible to the sales, the law provides that sales amounting to more than $100 must be advertised for a period of at least thirty days. In each sale the purchaser is required to execute a contract which contains the special regulations under which the cutting must be done. A reasonable time, depending upon the amount of timber included in the sale and the facilities of the purchaser for handling it, is allowed for the completion of the contract, but in no case can this exceed five years. Great care is exercised in awarding sales to prevent a monopoly of the lumber market in any district. In order to prevent the purchase of timber for purely speculative purposes, it is also provided by law that no contract is transferable, and contracts in which a period of more than one year is allowed for the cutting provide that a definite amount of timber must be cut and removed each year. Since the law requires that the full stumpage value of all timber must be obtained, the minimum stumpage rates provided for in the advertisement are, as nearly as can be determined, the full value of the timber. For the past year the cut on some of the forests on which the timber supply is limited has been restricted, and the annual cut on all the forests is being definitely limited as fast as the necessary data on which to base this action can be collected. In some forests sales are limited to the purely local markets, and in a few cases it has been necessary to restrict the annual cut to an amount below the local demand. It is an interesting fact that stumpage rates in forests which supply a purely local demand are considerably lower than in those forests from which the lumber is sold in the general market. In this way the Forest Service is able to be of material assistance to the homebuilder.'"[1]

Contrast the money returns to the government under the present forest policy with those from the still effective "Timber and Stone Act." A single sale of 12,000,000 feet of lumber in a Wyoming National Forest brought the government $60,000 and left the 1,500 acres from which it was taken in the hands of the people. Had the same land been sold with the timber at $2.50 per acre under the "Timber and Stone Act," the sale would have yielded only $3,750. Yet this is the least important distinction between the two methods of timber selling. Under the forest regulations a new crop is insured, while the timber supply is opened up to meet local needs and kept within reach of the small consumer.

From the economic standpoint, the matter of supreme importance in the development of this timber policy is that use has increased without reduction of the growing stock, and that this use has been enjoyed principally by the small operators and the homemakers. Thus, in the fiscal year ending June 30, 1901, timber was used without charge by only 283 applicants, and sales of timber numbered only 77; while in the last fiscal year (ending June 30, 1908) the number of free timber permits was 30,377, and the number of timber sales was 5,062. Even in the last year the amount of timber sold increased 102 per cent., and the number of sales increased 236 per cent. over the previous year.

With the other resources of the forests, growth in use has made similar strides under a form of regulation which invites use and at the same time conserves the resources. When the forests came under the administration of the forester (by direction of the Secretary of Agriculture) in 1905 the range had suffered from overuse because grazing had been conducted practically without regulation. It was, therefore, necessary for the safety of the forest and of the range rigidly to exclude stock where forest reproduction was en-

[1] "Cutting Timber in the National Forests and Providing for a Future Supply," by Raphael Zon and E H. Clapp, in the Yearbook of the U. S. Department of Agriculture for 1907.

dangered by grazing, and to reduce the number of stock using the ranges which had been overgrazed. Moreover, a charge was made for the grazing use. Nevertheless, while only 2,317 grazing permits were issued in 1901, there were issued last year 24,127 such permits. The number of stock grazed during the past season was: cattle, 1,304,142; sheep, 6,960,919; goats, 126,192; horses, 76,003; and hogs, 2,076.

The income from the use of the resources of the forests in the year ending June 30, 1908, was $1,842,281.

Under the head of special uses are classed, first, the use of water, and second, the use of the lesser resources of the forests. Permits for uses of this class up to and including 1905 numbered 298. Last year 3,141 special use permits were issued, covering 108 distinct kinds of use.

Of the three major resources of the forests, water ranks decidedly first in importance. The policy of the Forest Service in dealing with this resource has been exceedingly well given by Mr. Herbert A. Smith, of the service, in an article in the *National Geographic Magazine* for August, 1907, from which is quoted the following:

" Upon the mountain slopes of the national forests head the streams which, emerging from the mountains, are diverted into the ranchers' ditches and turn the brown of the desert to vivid green. These mountain slopes should remain forever forested. Once bared their early-melting snows and summer rains will pour into the rivers like water from a roof. Comparative measurements of stream discharge from forested and unforested basins alike in all other respects have been made in the West by the U. S. Geological Survey. They show sudden floods followed by low water in the former case, a relatively equalized flow in the latter. Neither the West nor the country can afford to suffer the monumental waste which forest denudation would mean.

" Many millions of dollars are now invested in National reclamation work. It is recognized that forestry is as necessary to the success of this noble and colossal plan to make fertile the desert as the dams and reservoirs which supplement Nature's storage. When the forests are stripped from the mountains the streams become silt-laden, and the builders of many a costly dam have seen their artificial lake fill up with worthless mud. The streams of the West are destined to play an important part in the upbuilding of industry and the supply of human needs through utilization as sources of power. This is particularly true in the Pacific Coast states. The Sierra Nevada and Cascade Mountains rise sharply to high altitudes and receive upon their western slopes a heavy rainfall. Thus almost ideal conditions are produced for power development. The streams of the Sierras light the city of Los Angeles, with its 200,000 inhabitants, and operate the electric railways which traverse its streets and spread their network out to the neighboring towns. The water wheels which generate this power and light are located within the national forests. So far as known, California has no good coal. A dense population is certain. The conservation of water power, the coal that does not waste away in the burning, is therefore vitally important.

"Since the profits of the corporations which have secured control of these sources of power are large, and since they are users of land in the national forests and benefit by the system of forest protection which the government maintains, there is no apparent reason why they should not be required to contribute something toward the cost of administration. Their case is not comparable with that of the users of water for irrigation, which supports the farmer and home-maker. In no way can a national forest better serve the purpose for which it exists than by increasing the number of farmers and home-makers. Therefore the irrigator need fear no charge."

SUMMARY.

Managed upon sound scientific principles, and run at the same time as a business conducted in the interest of the people, the national forests furnish an object lesson in the conservation of natural resources. This conservation is not restrictive; it does not withdraw the resources from the market and so increase the general drain upon similar resources in other parts of the country. On the contrary, the policy is a policy of development, first and foremost in the interest of the home-maker. This development involves economy and foresight, but it also emphatically involves use—the kind of use which maintains both the resources themselves and the progressive activities which depend upon them.

Thus, the existence of the national forests guarantees as nothing else could possibly do the stable economic welfare of the West, and so, implicitly, of the country as a whole.

This is the obvious economic value of the forests; but they possess a further economic value, less obvious but fully as important. They furnish a lesson in democracy, a means of educating the people in the right use of the natural resources, which, as the President has said, "are our national resources as well." They indicate how the average citizen may most certainly and justly be defended in his rights to an equitable share in these resources. As experience with forest conservation grows, there can be but little doubt that this lesson will be firmly grasped and that it will in turn react upon economic questions and so yet further safeguard the material basis of our national progress.

WORK OF THE DEPARTMENT OF AGRICULTURE FOR THE WEST IN THE DEVELOPMENT OF NEW PLANT INDUSTRIES.

B. T. Galloway,

Chief of the Bureau of Plant Industry.

That great section of the United States lying west of the 100th meridian is receiving considerable attention at the hands of the National Department of Agriculture. In view of the rapid settlement of the more humid sections and the work of other branches of the government farmers are flocking into the region, and are demanding information which will enable them to meet the new conditions in the growing of crops. The region is characterized by great diversity of climate and soil, and a corresponding possible diversity of its agricultural industries. During the last half century many isolated areas in this great region have been developed by the hardy pioneer to a state of productiveness far exceeding anything known in older sections of the country. By far the larger part of the agricultural products of these areas are secured from plants that have been introduced from foreign countries, some of which like the navel orange, grown in California, were brought in a good many years ago, and have resulted in the establishment of exceedingly important industries.

In the matter of building up new plant industries in this region the Department of Agriculture, through the Bureau of Plant Industry, is working along a number of lines. Several years ago investigations were inaugurated in the northwest section of the great plains area for the purpose of seeing what could be done in the way of introducing new crops. The possibilities of cereal production in this region were recognized. After careful study of the climate and soil conditions of the region in question an agricultural explorer was sent on a number of trips to Russia, with the result that several types of hard or durum wheats were introduced and disseminated. The original plan for introducing these wheats had for its object their utilization in the manufacture of macaroni, hence they were at first called macaroni wheats. It was found that these wheats could be grown under comparatively small rainfall and they therefore immediately became popular and in great demand by the farmers. Last year there were produced in this semiarid section nearly fifty million bushels of durum wheats. A large quantity, probably twenty-five million bushels, valued at fully twenty million dollars, was exported. Further studies of these wheats are being made and their adaptation to other conditions is under investigation. Using the durum wheats as a basis other types are being bred from them, which it is believed will still further extend the possibilities of wheat production, not only in the semiarid region of the northwest but in other sections where semiarid conditions prevail.

It has been recognized by the department that one-crop farming can not long be successful in any region, hence efforts are being put forth to secure forage plants of various kinds that may be used in rotation with cereals. With this end in view the department is conducting some important explorations in the dry, cold regions of Siberia. Professor N. E. Hansen, of the South Dakota Experiment Station, is now in Siberia in search of new forage crops, such as alfalfas, clovers, vetches, etc. Professor Hansen has made three trips to this region and the last one is mainly for the purpose of securing crops which are known to exist through discoveries made on previous explorations. It is highly important to secure legumes for this section, especially alfalfas. It is believed that the Siberian alfalfas which Professor Hansen has found will be an important acquisition to the agricultural resources of the country. The Bureau of Plant Industry, however, has already made good progress in the establishment of cold and drouth-resistant alfalfas for this whole northwest region. For the southwestern area, including the drier portions of southwest Texas, New Mexico, Arizona and California, other crops are being secured, introduced and tested. Valuable new kafir corns, milo maize, sorghums and crops of this type have been introduced, especially in the drier portions of Texas, and their usefulness in large measure established.

An important line of investigation, having for its object the establishment of a new crop industry in the southwest, has been inaugurated in cooperation with the Reclamation Service at Yuma. The growing of Egyptian cotton is the object of this work. The United States imports about fifteen million dollars' worth of Egyptian cotton, and it has been the desire for some years to establish the industry here if practicable. Very encouraging results have been secured through the work at Yuma and it is believed that a continuation of the investigations will bring about the establishment of a very important new industry.

It may be of interest to mention specifically some of the newer crops which are being introduced throughout the western portion of the United States.

Introduction of Emmer.—This is an important grain introduced from the drier sections of Russia and is a variety of wheat. The crop is now practically established in North and South Dakota. A new winter emmer has been secured which is more resistant to rust, cold and drouth than the sorts now in use. The crop is being recognized as a good stock food and is found well adapted to dry-land areas. The new winter-hardy variety also furnishes good fall pasturage.

Russian Proso.—This crop was also introduced from Russia and is especially adapted to the semiarid districts, being introduced for the purpose of furnishing a great amount of stock feed not otherwise available.

Grains for the Texas Panhandle.—Important experiments and demonstrations are being conducted with a view to introducing grains of various kinds into this section of the United States. Certain varieties of cereals, such as black winter emmer, various kinds of sorghums and kafir corns have been successfully established. The country is now largely devoted to grazing but as a result of the department's experiments winter wheat is now being grown to a considerable extent and the hard winter wheat production of the Texas Panhandle now compares well with that of western Kansas west of the 99th meridian.

Introduction of Beardless and Hull-less Barleys adapted to the Higher Altitudes.—This work is especially intended for the intermountain areas but portions of the western districts and the great plains sections will also benefit from these investigations. The object of the work is to secure varieties of beardless and hull-less barleys adapted to the higher altitudes, in order to furnish food for animals where little grain is now grown. Where elevation prohibits maturity of grain these new barleys furnish a highly nutritious and palatable hay. So far the Himalayan varieties have been the most successful, having matured seed at from 7,000 to 8,000 feet elevation. A valuable feature brought out in this introduction has been the fact that these high-altitude barleys also have considerable drouth resistance.

Introduction of Drouth-resistant Sorghums, Kafir Corns, etc.—This work is planned to establish the most hardy, drouth-resistant grain sorghums in the semiarid regions of the West and southwest, even in sections where almost all other crops fail because of drouth. Some very promising sorts have been brought in and tested with satisfactory results.

Extension of Turkestan Alfalfa, Cold and Drouth-resistant Alfalfas, etc.,—These crops have already been mentioned in our general discussion. The drouth-resistant qualities of Turkestan alfalfa, which was introduced a number of years ago, have been quite fully determined. The crop is found to be a valuable one for the semiarid regions east of the Cascade and Rocky mountains, the northern portion of the great plains area, and those portions of the irrigated districts which possess sufficient water for only partial irrigation. Compared to the ordinary strains, Turkestan alfalfa is demonstrating its superiority in portions of the great plains, especially in the colder and drier sections. It is exceeded only by the so-called sand lucern and other drouth- and cold-resistant types of alfalfa. An alfalfa introduced into the southwest from Arabia has proved to be, by far, the heaviest yielder in this section. This is the most successful alfalfa yet found for rapidity of growth.

Closely allied with the plant introduction work are other lines of investigation having for their object the development of new crops by breeding and selection. It is especially important to secure for all this region, and more particularly the southwestern portion of it, alkali and drouth-resistant crops. Numerous experiments are under way with various grasses and forage plants to ascertain which varieties are most resistant to drouth and to increase by breeding the resistance of the most promising kinds. There is found to be a great variation in the alkali resistance of some of these types of plants, and the breeding work is being specially conducted with the idea of keeping in view this important question of adaptation to alkaline soils.

For the past three years the department has had an agricultural explorer in China and other parts of the Orient. A good many valuable new plants have been discovered and sent here, and these are now being tested preparatory to their ultimate dissemination.

Connected with all of this important plant introduction work the department is carrying on other lines of investigation which are destined, it is believed, to be of great value from an agricultural standpoint. With a view to getting specific data, which will be of value to farmers already in the region and to those contemplating taking up land therein, an extensive series of investigations and experiments has been inaugurated at eleven or twelve stations representing the principal agricultural areas of the great plains. The best methods for conserving the moisture of the soil, best kinds of crops to grow, systems of rotations to be practiced, and other lines of work are being carried on at these stations. The stations are also conveniently located for cooperation with the state stations working along similar lines, and are exceedingly useful in the testing of the newer things that are being introduced and distributed by the department.

THE NINTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

HENRY G. BRYANT.

The congress which assembled in Geneva on July 27 last, and concluded its sessions on August 6, was the ninth of a series of such meetings, the first of which was held in Antwerp in 1871. The preceding congress, as many will recall, was held in America in 1904, when this society, among others, had the pleasure of entertaining many distinguished geographers.

In addition to my colleague Dr. Paul J. Sartain, two widely-travelled, lady members of this society were present as members of the congress and two others attended for a brief stay as visitors. An informal reception was held on the evening of July 26 and the following day the congress was formally opened under the presidency of Dr. Arthur deClaparède in the presence of the president of the Swiss Confederation. The sessions were held at the University of Geneva, whose classrooms afforded admirable quarters for the sectional meetings although, it must be admitted, the general auditorium where the larger meetings were held, left much to be desired in the way of quiet accessories. The comparative accessibility of Geneva resulted in a large membership and many names famous in connection with geographical science were found among the 750 subscribing members. The length of the present meeting—eleven days—extended far beyond the limits of previous congresses; but this increased responsibility was fully met by the private citizens and the municipality of Geneva, who provided banquets, receptions, garden parties, a theatrical performance, fireworks and illuminations and an excursion on the lake or some similar diversion for each hour that was not consecrated to the purely formal sessions of the meeting.

To refer at length to the individual papers presented in a gathering where so many representative men took part, would be invidious and would tax the reader's patience. Let me mention however, that interesting papers were presented by such authorities as Professor A. Penck, of Berlin, who is filling this year the post of

Kaiser Wilhelm Professor at Columbia, while Professor Wm. M. Davis, of Harvard, is representing America as exchange professor at the University of Berlin. Professor Henri Cordier, of Paris, presided over the section of historical geography and Professor Nordenskiöld, of Sweden, over that devoted to exploration. A learned contribution was presented by Professor Oberhummer, of Vienna, on Leonardo daVinci and his influence on the geography of his time. Another paper which excited much good-natured discussion was that by M. Alexandre Monet on the scarab containing the record of the circumnavigation of Africa under King Necho. Other communications of special interest were those of M. Ch. Lallemond on the "Respiration of the Earth." M. Lecointe on the "Organization of the International Polar Institute" and Dr. Filchner on his "Explorations in Eastern Thibet." It fell to the lot of your delegate to present a message of greeting from Commander Peary to the congress, which was received in a most sympathetic spirit by the members.

A fair idea of the results of the sessions may be obtained from an examination of the resolutions adopted at the concluding session. These deal with a multiplicity of subjects and as they reflect the consensus of opinion of those present on the subjects referred to, will doubtless exert considerable influence among the societies and governments interested. Heretofore it has been a just criticism of the work accomplished at these international meetings, that the committees appointed to carry out the resolutions scattered to the remote ends of the earth directly the congress adjourned, and in the intervening period, no real progress was made. At the Geneva meeting, a distinct innovation was made in the treatment of two of the most important resolutions considered and the practical advantages resulting therefrom may be set down as distinct triumphs of the recent congress.

As far back as the London meeting in 1895, at the suggestion of Professor Penck, a committee was appointed to secure international cooperation in a project to produce a map of the world on a scale of 1 to 1,000,000, or about 16 miles to the inch. Aside from a series of sheets on this scale issued by the United States Geological Survey and by Great Britain, France and Germany, no substantial progress has been made. At Geneva, on the initiative I believe of the English-speaking delegates, a number of those specially interested were appointed on a committee to consider on the spot the various problems connected with the proposed map. This committee held a number of meetings, and after due deliberation, agreed upon certain conventional symbols to represent various features on the map, selected Greenwich as the standard meridian, and further agreed upon the lettering, the size of the sheets, etc. These proposals were embodied in a resolution which was approved by the congress and will now be submitted to the various governments for their approval. It is to be hoped that in this practical way a long step has been taken towards securing a uniform standard map of the world.

In a similar way, the details concerning the formation of an International Cartographic Association were considered by a competent committee, whose recommendations were adopted by the congress. As a result, we may soon hope to see issued a series of maps which will show at a glance the progress of exploration in different parts of the globe. In view of their importance, these two resolutions are reproduced below in full.

Great credit is due to Dr. deClaparède who worked unceasingly to secure the success of the meeting and presided over the sessions with accomplished skill and courtesy while Mme. deClaparède won universal esteem by her gracious kindness to all.

While some of the former congresses held in the larger European capitals, may have excelled the present one in stately dignity of environment, none have surpassed it in a profuse hospitality which made all welcome and filled in the time with delightful diversions. It goes without saying, that the recipients of all these favors carry away lively memories of these manifestations of good will, and, while the mental stimulus derived from listening to the lectures and discussions must be manifest to everyone, after all, perhaps the chief function of these meetings is the opportunity which they afford for scientific travellers, educators and scholars of the various countries to meet together in friendly intercourse at these strictly social and unscientific functions. Thus, in their way, these congresses accomplish a good purpose in aiding to a clearer understanding of the many problems of geography and in helping to extend a feeling of toleration and brotherhood among the nations of the earth.

RESOLUTIONS.

The Map of the World on the Scale of 1:1,000,000.

At the general meeting of the Ninth Geographical Congress held at Geneva on the twenty-seventh of July, 1908, the following resolution was unanimously passed:

Resolution.

WHEREAS the map-making offices of several nations are engaged in compiling maps, to be published on a uniform scale of 1:1,000,000, under uniform agreements as to limits of sheets, etc.

Resolved that it is desirable, for manifest reasons, that a uniform set of symbols and conventional signs be adopted by all nations for use upon these maps.

Resolved that an International Committee should be formed to consider the question, and that, in order to provide a basis for the discussion, each government and other map-producing office should be requested to supply to the committee, within the next twelve months, specimens of the 1:1,000,000 maps which have been produced.

In pursuance of the terms of the above resolution the President appointed a committee to consider the question and to make recommendations.

The committee assembled and unanimously made the following recommendations; with the request that they should be communicated in the name of the International Congress to the governments concerned and to the geographical societies represented at the Congress:

1. In accordance with the recommendation of the International Geographical Congress held in London in 1895, each sheet of the map should cover an area 4 in latitude by 6 in longitude.

The limiting meridians of the the sheets should be at successive intervals, reckoning from Greenwich, of 6; and the limiting parallels, reckoning from the equator, should be at successive intervals of 4.

Each degree line should be drawn right across the sheet.

2. The projection should, as recommended in 1895, be a polyconic projection, each sheet being plotted independently on its central meridian.

3. A scale of kilometers should be drawn on each sheet. An additional scale of miles may be drawn if required.

4. The heights above mean sea-level should be shown in meters; the values in feet may be added if desired.

5. Normally contours should be drawn at vertical intervals of 200 meters, reckoning from sea-level. But in very hilly districts the contours may be at larger vertical intervals, which should, however, be multiples of 200 meters. In very flat country additional contours may be inserted, provided that the intervals are even fractions of 200 meters. The color of the contours should be brown.

Minor features which cannot be shown by contours should be shown by shading.

In addition, it is desirable that the successive altitudes should be indicated by a system of color-tints.

A definite scale of tints should not be decided upon until after the preparation of specimen sheets on the general lines of these recommendations.

6. Generally water should be shown in blue, but a distinction should be made between perennial and non-perennial streams. The depths of the sea and of lakes should be shown by blue contours, the vertical intervals being multiples or fractions of 200 meters. Features which cannot be shown by the contours may be shown by blue shading. The datum level in each case is to be the surface of the sea or lake. In the case of rivers, rapids and other obstructions to navigation, are, as far as possible, to be indicated.

7. Roads and tracks should be divided into two classes—those which are suitable for wheeled traffic, and those which are not.

8. The lettering should be in varieties of the Latin characters. A distinction should be made between the lettering applied to cultural (artificial) features and the lettering applied to natural features.

In those cases in which the Latin characters are not in use in the country in which the sheets are produced, two editions should be published, one the national edition and one the international.

9. A clear distinction should be made between the representations of features known to have been surveyed with sufficient accuracy to render any subsequent important alteration improbable, and the representation of those features which have been imperfectly surveyed or only roughly explored.

Proposition Relating to the Formation of an International Cartographic Association and Relating to the Publication of a Répertoire Graphique.

In the session of Section I, held July 29, 1908, General de Schokalsky, of St. Petersburg, proposed the formation of an International Cartographic Association, already proposed in the Congresses of Berlin and Washington, which should have for its principal object the collection of cartographic documents and the unification of conventional signs on maps, and other similar duties.

In the same session, M. F. Schrader, of Paris, exhibited a répertoire graphique, which indicated in a simple and distinct manner the actual progress of exploration over the world; he showed to the section the manner of using the répertoire, which can be kept up to date by the united action of geographical societies and of geographers in various countries, and proposed its adoption by the congress as a practical aid in geographical investigation.

On motion of Professor Davis, of Cambridge, Mass., the first section adopted a resolution requesting the president of the congress to name a committee chosen from among the members present at this meeting, to consider during the session of the congress the propositions of MM. de Schokalsky and Schrader, and to report at a general session the action which the congress should in their opinion take in these matters.

The president of the congress having appointed the committee, and given it the right to add to its number, the committee designated by him has the honor to make the following recommendations:

1. That the proposal of M. Schrader regarding the répertoire graphique be adopted:

2. That the commmittee be continued as a permanent committee of the congress with authority to take steps toward the publication of the répertoire graphique.

3. That the action proposed by this committee, together with that proposed by the committee on the map of the world 1:1,000,000, shall constitute the first and most practical steps toward the work of an International Cartographic Union.

If these three recommendations are adopted by the congress, the committee proposes to act in the following manner.

(*a*) To prepare a plan for the general publication of the répertoire graphique; to secure estimates of the cost of publication of successive editions of the répertoire from responsible map publishers; and thus to determine a price at which the répertoire can be furnished to subscribers.

(*b*) To request the principal geographical societies to publish in their journals a specimen sheet of the répertoire as now prepared by M. Schrader and selected by the committee and a statement of the terms on which the répertoire can be furnished to subscribers.

(*c*) To proceed eventually with the publication of the répertoire if subscriptions are secured in sufficient number to warrant the undertaking.

(*d*) To invite collaboration in the work of maintaining the répertoire up to date.

ANOTHER DRIFT-CASK REPORTED

Mr. Henry G. Bryant contributed the following letter to the New York *Sun* of January 18, 1909, in reference to the reported recovery of another of the drift-casks sent out by this Society.

The following cable message appeared in *The Sun* of January 11: "Christiania, January 10.—A letter from Soro Island, Finmark, Norway, states that a buoy which came ashore there on November 3 contained a letter stating that the buoy was launched at Cape Bathurst, British America, on July 24, 1900. The buoy seems to have drifted between Greenland and Spitzbergen to Norway, thus supporting Capt. Amundsen's theory on which he bases his future polar expedition."

The writer is convinced that this is drift cask 26, which was one of thirty-five such casks set adrift in the Arctic Sea north of Alaska during the years 1899-1901 with the object of securing data as to the direction and speed of the circumpolar currents.

At the suggestion of the undersigned and of George W. Melville, U. S .N., retired this experiment was undertaken and carried out by the Geographical Society of Philadelphia. The strongly made spindle-shaped casks were each numbered and contained messages in four languages requesting the finder to report to the home society or the nearest United States Consul the time and place where each was recovered, with the name of finder, etc. Through the efficient cooperation of the captains of steam whalers sailing from San Francisco and the officers of the United States revenue cutter *Bear,* these casks were distributed on the floe ice and the exact location where each one was launched was duly reported to the society. In the interval which has now passed the recovery of four of these casks has been reported.

The successful drift of Cask No. 6 from a point west-northwest of Point Barrow, Alaska, where it was placed in 1899, over a 2,500 mile course across the north polar area to the most northern point in Iceland—Cape Rauda Nupr—attracted wide attention at the time and did much to strengthen belief in the existence of the drift.

Subsequent to the receipt in Philadelphia of this much travelled message two other records were received, from casks which had failed to enter the true central drift and gone ashore on points on the Siberian coast. The news recently received of the recovery of another member of this silent flotilla at a point on the Norwegian coast south of North Cape gives additional interest to the undertaking. The cask referred to—No. 26—was launched by Capt. R. J. Cumiskey of the steam whaler *Narwhal* in latitude 71 degrees north, longitude 128 degrees 5 minutes west off Cape Bathurst, on July 24, 1900—as reported to the United States Hydrographic Bureau at Washington by Capt. Cumiskey and by an official of that bureau forwarded to the society. From other reports received it appears that four other casks were placed adrift in practically the same region—off Banks Land. This is the only one of this group that has been heard from. Although the exact course followed by cask No. 26 must remain largely a manner of conjecture, it is more than probable that its drift carried it northward past Prince Patrick Island and Grant Land and thence around or across the polar area and eventually into the sea between Greenland and Spitzbergen—thus reaching the north Atlantic.

Assuming that the cask followed the most direct route it is evident that it travelled approximately 2,400 miles in the eight years, three months and ten days which elapsed. If, however, as is more probable, it followed a more circuitous route similar to those heretofore taken in the drift of the *Jeanette* and *Fram,* the mileage would be much greater.

Bearing in mind that thus far but two casks have made the journey across the polar area and that in both instances, over five years were occupied in transit, some may question the value of the results obtained. In answer to this view of the question, as before remarked (*Bulletin Geographical Society of Philadelphia,* January, 1906), it may be well to remember that doubtless other casks will be reported from time to time, and in this connection we should not forget the vast extent of the Arctic Ocean, which comprises an estimated area of between four or five million square miles and which presents difficulties of navigation not comparable to those of the temperate zone. The remoteness of the region traversed by these casks must be considered, and it must also be remembered that even when brought to their journey's end by the great elemental forces mentioned they are even then in regions afar from the haunts of civilized men. All these circumstances render the recovery of these messengers at best a piece of rare good fortune.

The drift cask experiment was undertaken to secure data to prove the existence of just such a current; and the safe arrival of another of the flotilla by the prescribed route is a source of satisfaction to those who have had faith in the existence of such a current.

GEOGRAPHIC NOTES AND NEWS

The *Geographical Journal* (London) for November contains a short but very interesting article by Professor W. M. Flinders Petrie, on the Egyptian scarabs, purporting to give an account of the first circumnavigation of Africa, dated about 600 B. C. The scarabs are thoroughly discredited as very clever forgeries, but the facts in the case are well worth preserving. Two cuts show the skillful workmanship of the unknown fabricator.

At the meeting of the British Association held in Dublin in September, Professor W. M. Davis delivered an address on "The Physiographic Subdivisions of the Appalachian Mountain System, and their Effects on Settlement and History."

Plans for a new Norwegian polar expedition, according to *Science*, were announced by Captain Amundsen at the meeting of the Geographical Society in Christiania early in November. The intention is to drift across the Polar Ocean in Nansen's old ship, *The Fram*, starting from Cape Barrow.

The *Meteorologische Zeitschrift* (May, 1908) in an article by V. Kremser points out that the air of large cities like Paris, Vienna and Berlin is both absolutely and relatively drier than in the neighboring country. The difference is most marked in mid-summer. The reason for the difference is to be found partly in the higher temperature of town air and partly in the condition of drainage—much more rapid in the city and hence less favorable to large evaporation.

Mr. Herbert L. Bridgman, Secretary of the Peary Arctic Club, received word from Commander Peary, late in September, that all were well and prospects were good.

The Sixteenth National Irrigation Congress which met in Albuquerque, on September 29, was the most successful ever held, according to *Conservation* (November). The congress declared strongly in favor of Southern Appalachian and White Mountain forest reserves, and considered at length the important question of conserving water powers.

According to despatches to the London papers from New Zealand, the *Nimrod* sailed on December 1 from Lyttelton for King Edward VII. Land, to take on board Lieutenant E. H. Shackleton, R.N.R., and his party of explorers, who, for the best part of the year, have been engaged in an attempt to reach the South Pole. The *Nimrod* left England in August, 1907, and arrived at New Zealand on November 23, 1907. After embarking Lieutenant Shackleton and the other scientific men and explorers, the *Nimrod* left Lyttelton on January 1, 1908, and made her way southward to the ice-pack. The explorers landed and the *Nimrod* came back to Lyttelton. Since then she has undergone a thorough overhaul, and the scientists' quarters on deck have been enlarged to nearly twice their original size, so that in the event of any of the shore party being ill they would have some place to use as a hospital. It is anticipated that six weeks will be taken in the passage from Lyttelton to the landing place in the far south. Lieutenant Shackleton and his party will, it is hoped, put in an appearance before the end of February, after which the *Nimrod* would make her way back to Lyttelton. It appears improbable that the ship will have to winter in the Antarctic. The vessel takes with her from Lyttelton to the Antarctic 280 tons of coal, and stores sufficient to last thirty-eight men for one year. She is now commanded by Lieutenant F. P. Evans, R.N.R., who was master of the steamer which towed the *Nimrod* from Lyttelton to the ice-pack at the beginning of the present year.

The Fifth Annual Meeting of the Association of American Geographers was held in Baltimore, January 1 and 2, in affiliation with the convocation week of the American Association for the Advancement of Science. From the standpoint of attendance and contributions offered, the sessions were unanimously declared to be an eminent success.

Professor Albrecht Penck gave a special lecture on "The Relation between Climate, Soil and Man," on Thursday evening, December 31, pointing out in a highly suggestive way the many intimate associations between man's dwelling place and these two important elements of his environment.

Among the other contributions, special attention was attracted by President Gilbert's address on "Earthquake Forecasts," by Professor A. P. Brigham's paper on "The Capacity of the United States for Population," and the Round Table Conference, presided over by Professor R. E. Dodge. Dr. Gilbert made the point very clear that any kind of valuable forecasting of earthquakes is, as yet, entirely impracticable, and that anything but accurate forecasting is highly undesirable. While it is possible to foretell, in general, what regions may suffer from violent earthquakes in the future, the inability to foretell the exact place and time of occurrence make such speculations valueless from the standpoint of preventing or averting loss when the earthquake does come.

The paper by Professor Brigham, and the discussion which it aroused, brought out the general agreement that this country, even the eastern half of the country, is physically capable of maintaining a population several times larger than the present number for the entire United States.

At the Rount Table Conference to discuss the teaching of Geography, especially in Secondary Schools, the most striking points brought out were the great increase in the teaching of the subject and the unsatisfactory manner in which it is taught. The practically unanimous declaration in favor of a larger introduction of the human side of geography was most gratifying, and was borne out by the majority of the contributions delivered before the Association.

ACTIVITIES OF THE SOCIETY

STATED MEETING.

NOVEMBER 4, 1908.

At the opening meeting of the year President Alba B. Johnson made a brief survey of the progress of geography during the past year. Mr. Henry G. Bryant reported the proceedings of the Ninth International Geographical Congress at Geneva, to which he went as a representative of this society. His report is printed in this issue of the BULLETIN. Professor Emory R. Johnson delivered the principal address of the evening, his subject being "The Conservation Movement." His address dealt with the whole broad movement toward the conservation of natural and national resources. Especial emphasis is placed on the importance of the movement in recent years under the impetus given it by President Roosevelt, his conference of the governors, and the appointment of the Conservation Commission. In the course of the address Professor Johnson presented many striking facts concerning the water, forest, mineral and soil resources, supplementing his remarks by numerous well-chosen illustrations. The details of some of the more salient points in the discussion are to be found in the article by Professor Johnson in the October BULLETIN.

AUTUMN EXCURSIONS.

The Excursions Committee provided two enjoyable outings for members of the society, the river trip, and the walk along the valley of Crum Creek. On the latter trip the number in the party was entirely too small, in consideration of the picturesque character of the region visited, perhaps the most delightful and instructive trip to be made in the immediate vicinity of the city.

FROM BAHIA TO LIMA.

ADDRESS BY

PROFESSOR J. W. BREWSTER,

AT THE

STATED MEETING,

December 2, 1908.

No other continent perhaps is the occasion of so much present-day interest as is our sister continent to the south, with which one might almost say, we are only recently becoming acquainted. Professor Brewster took his hearers on an interesting journey through many of the most delightful parts of the South American countries, making the journey seem most realistic by the great number of wonderfully executed pictures. Few, indeed, have been the opportunities to enjoy a more charming series of views, so carefully chosen and so beautifully colored.

THE ORIGIN OF THE ALPS.

ADDRESS BY

PROFESSOR ALBRECHT PENCK,

AT THE

SPECIAL MEETING,

December 10, 1908.

The society was especially fortunate in securing for its special December meeting, Professor Penck, of the University of Berlin, now in this country as Kaiser Wilhelm Professor at Columbia University and Silliman Lecturer at Yale. The subject, though technical and somewhat complex, was made most readily intelligible to all by the able manner in which it was presented. No other topic of European physiography is so interesting as the genesis of that continent's most famous mountain mass in which, as the speaker clearly indicated, some of the most important features could be explained only by assuming general lifting and lateral movements of the strata. To have this topic so clearly expounded by the foremost European physiographer made a truly enjoyable lecture.

The Executive Committee have already arranged the following partial list of lectures for the remainder of the year.

MONTHLY MEETINGS.

January 6, 1909—Mr. Frederick Monsen, "The Indians of the Painted Desert."

February 3, 1909—Dr. Ellsworth Huntington, "A Raft Trip down the Euphrates."

March 3, 1909—Mrs. Harriet Chalmers Adams, "The Andean Wonderland."

INTER-MONTHLY MEETINGS.

January 15, 1909—Mr. S. F. Houston, "A Glimpse of Greece and Greek Islands."

February 12, 1909—Mr. Benjamin R. Hoffman, Mr. Alba B. Johnson, "Spain."

February 26, 1909—Mr. Edward I. H. Howell, "Cornwall, England."

March 12, 1909—Miss K. A. R. Colgan, "Ireland," Mr. Benjamin R. Hoffman, "Scotland."

March 26, 1909—Mr. S. Hudson Chapman, Mr. S. F. Houston, "Northern France."

April 16, 1909—Mr. Edwin Stanley Thompson, "Holland and Belgium."

BOOK NOTES AND REVIEWS

Baedeker, Karl. *Spain and Portugal.* Pp. 588. 3d Ed. Published by the author, Leipzig, 1908.

These standard handbooks are calculated to make the traveller as much as possible independent of guides, hotel keepers and the like, and aid in every way to increase the personal enjoyment of his tour. Where hotel standards present the conditions to be found in the peninsula, such a thoroughly reliable and impartial verdict as the handbook affords, is doubly indispensable. The completeness of detail for which "Baedeker" stands, is here presented with the latest information on the subjects so important to the traveller's comfort and pleasure.

Dunn, Robert. *The Shameless Diary of an Explorer.* Pp. 297. Outing Publishing Company, New York, 1907.

First appearing in serial form in the *Outing Magazine* these ostensible transcripts from an explorer's diary are now collected for permanent preservation in book form. The scene follows Dr. Cook's first expedition to Mt. McKinley in the summer of 1903, the author having been one of the party on that unsuccessful attempt to reach the "top of the continent." Whatever attitude one may take on the ethical aspects of publishing the unvarnished details of personal difficulties and dissentions, it must be admitted that the account is entertaining in its way. It is perhaps best described as the "minority report" or the dissenting opinion, and as such, it gives a glimpse of one side of the exploring game, which the outside world is not often granted. The hardships and discomforts of the trail, like nothing else, will bring out and reveal the last shred of a man's inmost soul. This fact, well known to all who have tried the sport of pack train and no trail, gives much ground for accepting the diary as literally true, without exaggeration or subsequent coloring, simply the daily story of an exceptionally unfortunate combination of antagonistic personalities. With its intimate touch of the real camp life it cannot fail to be interesting, though the impression which is left with the reader is not likely to be entirely flattering to the author.

Maxwell, Donald. *A Cruise Across Europe.* Pp. 254. John Lane Company, New York, 1907.

A decidedly entertaining volume containing notes taken by the way on a voyage from Holland to the Black Sea through the inland waterways of Europe. The book is really a delightful series of sketches, well written, and most attractively illustrated with artistic pictures by the author and Cottington Taylor.

McDonald, A. *In the Land of Pearl and Gold.* Pp. 318. Blackie & Son, Glasgow, 1907.

This little volume is one of the most enjoyable of all the recent books of travel and adventure. One wanders through the land of gold and learns at first hand how to "peg a claim," dig a shaft or join a "rush," without ever tiring of the company in which he finds himself. In the opal mines or the guano fields, it matters not which, the same keen, wide awake spirit of the adventure, maintains the lively interest in wondering what will happen next.

Schwarz, G. F. *The Longleaf Pine in Virgin Forest.* Pp. 135. John Wiley & Sons, New York, 1907.

The virgin forests of the south have afforded unusual opportunities for observing the particular characteristics and natural tendencies of the longleaf pine, one of the most important trees, commercially, and extensively distributed throughout one of the chief timber-producing sections of the country. The author points out the significant fact that it is naturally adapted to the methods of systematic forestry, the present volume serving largely as a guide to those who care to secure the best results from the tree by favoring its natural tendencies. Nearly one third the volume is devoted to the question of fires, an aspect, which in pine forests, may perhaps be regarded as the first consideration. The soil conditions, rate of growth of trees and actual forest management are also discussed at some length. Numerous illustrations supplement the text.

Wetherill, H. E. *Hygromedry.* Pp. 82. Published by the author, Philadelphia, 1906.

This small volume states briefly the possibilities of hygrometry as applied to the practice of medicine, the contention being that observations of the bodily moisture have diagnostic values in special diseases. Much of the volume is devoted to an explanation of the "hygromed," an invention by the author for use in this connection.

RECENT ACCESSIONS TO THE LIBRARY OF THE SOCIETY

AMERICA, NORTH AND CENTRAL.

CANADA .... CHAMBERS

Canada's Fertile Northland; a glimpse of the enormous resources of part of the unexplored regions of the Dominion. Evidence heard before a select Committee of the Senate of Canada during the Parliamentary Session of 1906–7, and the report based thereon. Edited by Captain Ernest J. Chambers. Ottawa, Government Printing Bureau: 1908. Illustrations and maps in separate case. *Presented by the Minister of the Interior, Canada.*

UNITED STATES—ALASKA .... BROOKS AND OTHERS

Mineral Resources of Alaska Report of Progress of Investigations in 1907. By Alfred H. Brooks and others. (U. S. Geol. Surv. Bull. No. 345.) Washington: 1908.

Geology and Mineral Resources of the Controller Bay Region, Alaska. By G. C. Martin. (U. S. Geol. Surv. Bull. No. 335.) Washington: 1908.

The Fairbanks and Rampart Quadrangles, Yukon-Tanana Region, Alaska. By L. M. Prindle. (U. S. Geol. Surv. Bull. No. 337.) Washington: 1908.

The Gold Placers of Parts of Seward Peninsula, Alaska, etc. Various authors. (U. S. Geol. Surv. Bull. No. 328.) Washington: 1908.

The Ketchikan and Wrangell Mining Districts, Alaska. By F. E. and C. W. Wright. (U. S. Geol. Surv. Bull. No. 347.) Washington: 1908.

UNITED STATES—ARKANSAS .... BRANNER

The Clays of Arkansas. By John C. Branner. (U. S. Geol. Surv. Bull. No. 351.) Washington: 1908.

UNITED STATES—CALIFORNIA .... MENDENHALL

Preliminary Report on the Ground Waters of San Joaquin Valley, California. By Walter C. Mendenhall. (U. S. Geol. Surv.—Water Supply Paper No. 222.) Washington: 1908.

UNITED STATES—COLORADO .... GALE

Geology of the Rangely Oil District, Rio Blanco County, Colorado. By Hoyt S. Gale. (U. S. Geol. Surv. Bull. No. 350.) Washington: 1908.

UNITED STATES—GEOLOGY .... HAYES AND LINDGREN

Contributions to Economic Geology, 1907. Part 1—Metals and Nonmetals, except Fuels C. W. Hayes and Waldemar Lindgren. (U. S. Geol. Surv. Bull. No. 340.) Washington: 1908.

UNITED STATES—IDAHO............................RANSOME AND CALKINS

The Geology and Ore Deposits of the Cœur D'Alene District, Idaho. By Frederick Leslie Ransome and Frank Cathcart Calkins. (U. S. Geol. Surv.—Professional Paper No. 62.) Washington: 1908.

UNITED STATES—KENTUCKY AND VIRGINIA..........................STONE

Coal Resources of the Russell Fork Basin in Kentucky and Virginia. By Ralph W. Stone. (U. S. Geol. Surv. Bull. No. 348.) Washington: 1908.

UNITED STATES—OHIO .... GRISWOLD

Structure of the Berea Oil Sand in the Flushing Quadrangle, Harrison, Belmont and Guernsey cos., Ohio. By W. T. Griswold. (U. S. Geol. Surv. Bull. No. 346.) Washington: 1908.

UNITED STATES—TRANSPORTATION...........JOHNSON, SANFORD AND OTHERS

Transportation by Water, 1906. By Emory R. Johnson, Frank L. Sanford and others. Published by the Department of Commerce and Labor, Bureau of the Census, Washington: 1908. *Presented by the Bureau of the Census.*

UNITED STATES—UTAH................................LEITH AND HARDER

The Iron Ores of the Iron Springs District, S. Utah. By C. K. Leith and E. C. Harder. (U. S. Geol. Surv. Bull. No. 338.) Washington: 1908.

EUROPE.

AUSTRIA .... BAEDEKER

Osterreich. By Karl Baedeker. Leipzig: Karl Baedeker, 1898. Maps and Plans. *Presented by Miss Florence Keen.*

NORTHERN GERMANY .... BAEDEKER

Northern Germany. By Karl Baedeker. Leipzig: Karl Baedeker, 1890. Maps and Plans. *Presented by Miss Florence Keen.*

RHEIN .... VON TEIN

Ergebnisse der Untersuchung der Hockwasserverhaltniss im Deutschen Rheingebeit. Part 8—Der Abflussvorgang im Rhein unter der wechselnden, Wasserlieferung des Stromgebietes und die Vorherbestimmung der Rheinstande. By M. Von Tein. Berlin: Wilhelm Ernst & Sohn, 1908. *Presented by the Zentralbureau für Meteorologie und Hydrographie im Grossherzogtum Baden.*

SOUTHERN GERMANY .... BAEDEKER

Southern Germany and Austria. By Karl Baedeker. Leipzig: Karl Baedeker, 1887. *Presented by Miss Florence Keen.*

POLAR REGIONS.

The Northwest Passage. Being the record of a voyage of Exploration of the ship "Gjoa," 1903-07. By Roald Amundsen, with a supplement by First Lieutenant Hansen. New York: E. P. Dutton & Co., 1908. Illustrations and Maps. 2 vols. *Presented by the Author. To be Reviewed.*

MISCELLANEOUS.

BOTANY.

Nineteenth Report of the Missouri Botanical Garden, 1908. St. Louis, 1908. *Presented by the Director of the Missouri Botanical Garden.*

ETHNOLOGY.

26th Annual Report of the Bureau of American Ethnology, 1904–05. Washington: 1908.

FUELS .... MILLS

Binders for Coal Briquets. By James E. Mills. (U. S. Geol Surv. Bull. No. 343.) Washington: 1908.

MINE EXPLOSIONS.......................................VARIOUS AUTHORS

The Prevention of Mine Explosions. Report and Recommendations. (U. S. Geol. Surv. Bull. No. 369.) Washington: 1908.

STRUCTURAL MATERIALS .... HUMPHREY

The Strength of Concrete Beams. By Richard L. Humphrey. (U. S. Geol. Surv. Bull. No. 344.) Washington: 1908.

MAPS.

Pilot Charts of the North Atlantic Ocean for October, November and December, 1908.

Pilot Charts of the North Pacific Ocean for November and December, 1908.

CANADA.

Map of the Dominion of Canada showing proposed addition to Manitoba and Ontario. Ottawa: Department of the Interior, 1908. *Presented by the Department of the Interior.*

CANADA.

Map of the Dominion of Canada showing Mineral Deposits. Issued by the Geological Survey of Canada.

NOVA SCOTIA.

Map of the Province of Nova Scotia. Issued by the Geological Survey of Canada, 1906.

Plans and Sections of the following Gold Districts of Nova Scotia: Brookfield, Caribou, Fifteen Mile Stream, Forest Hill, Goldenville, Harringan Cove, Isaac's Harbor, Lake Catcha, Lawrencetown, Leipsigate, Malaga, Mooseland, Moose River, Renerew, Salmon River, S. Uniacke, Tangier, Upper Seal Harbor, Waverley and Wine Harbour. Published by the Department of the Interior, Canada, 1898–1908.

JAPAN.

Hitoyoshi, Suanada, Shimogata, Kamiagata, Wajima and Aomori Sheets. Issued by the Geological Survey of Japan, 1907–08.

SOUTH AMERICA: ITS GENERAL GEOGRAPHICAL FEATURES AND OPPORTUNITIES.

JOHN BARRETT,

Director of the International Bureau of the American Republics.

From a geographical standpoint South America is most fascinating. The more one studies its contour and the relation thereof to the future of the nations which occupy its limits, the more one realizes the truth of Humboldt's prophecy that no other section of the world offers greater opportunities for the expansion and influence of the white race. The casual observer is surprised when he is told that, aside from having the largest river in the world, South America has the highest body of navigable water in the world in Lake Titicaca; the highest mountain peak on the western hemisphere, Aconcagua or Sorata; possibly the most extensive forests in the world, and the greatest variety of climate of any continent on the earth's surface.

On the other hand, the student, who is looking for causes and effects, becomes most enthusiastic over South America when he notes how carefully nature has provided favorable conditions for life, even in the very heart of the tropical section of that continent. By his own investigations and travels he finds that, in Colombia, Venezuela, Ecuador, Peru, Bolivia, and in some sections of Brazil, there are large plateau areas located in the tropical belt and yet possessing sufficient altitude above the sea to enjoy a climate like that of the better portion of the temperate zone. An interesting comparison, which enables one to appreciate this situation, can be stated in the following terms: If a man happens to be on the equator at sea level in Ecuador, and then mounts a mule and rides up to the nearest plateau, say at an elevation of 5,280 feet or one mile, he will find a greater change of climate and temperature towards moderate conditions than if he traveled to a point one thousand miles due north or south from the equator on board a ship. If he is not satisfied with this experience and continues his climbing to an altitude of 10,500 feet, or practically an elevation of two miles, which is the distance above the sea of numerous plateaus in the countries already mentioned, he will find himself in a climate and temperature cooler and more equable the year round than the one he would reach if he traveled to a point two thousand miles due north or south from the equator!

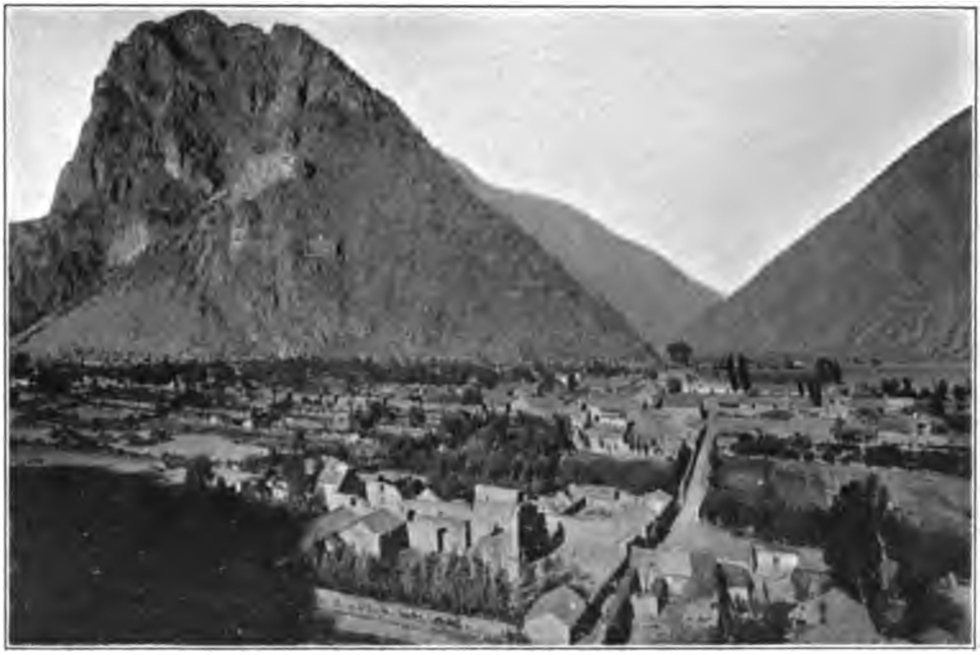
This remarkable provision of nature was brought home to me both through my residence as United States Minister at Bogotá, Colombia, and during a long overland journey of nearly a thousand miles, which I made in 1906 with Mr. Mahlon C. Martin, of Glen Ridge, N. J., along the Cordillera from Bogota to Quito, the capital of Ecuador. The barometer showed that my front doorstep was approximately nine thousand feet above the level of the sea, and, although Bogota is only three hundred miles from the equator, or much nearer than Panama, the thermometer on the doorpost seldom reached above 75° F., and rarely below 58° F. The average temperature was between 65° F. and 70° F. the year round—giving almost ideal conditions for the enjoyment of life. The plateau on the edge of which Bogotá is located is as level as a floor and covers an area as large as the state of Connecticut. Where possibly now live three hundred thousand people, two millions could make their homes. Frequently in riding along the Andes I would spend the night at an elevation of twelve thousand feet where I would have to cover myself with many blankets to keep warm, and at noon the next day I would be down at an elevation where the most comfortable clothing was that of the monkeys chattering in the trees. It is literally true that I have often seen upon one mountain side on the western slope of the Andes the products of every climate growing in prodigality. Up at the top of the mountain would be wheat, further down potatoes, then would come corn; below that we could see sugar cane, and further down yucca, bananas and other products of the very heart of the tropics. One of the most delightful memories of this eventful journey was that of spending a few days in the comfortable house of a polished Colombian gentleman, from whose veranda, and on whose own estancia reaching from an elevation of ten thousand feet down almost to sea level, I could see all these products which I have mentioned. The house was about six thousand feet above the sea, and the climate was ideal the year round. He had on his table each day the most wonderful variety of good things to eat that could possibly be imagined, and the weary travelers felt that they did not need to go wandering over the wide world to enjoy every climate and its fruits and delicacies.

South America in its magnificent extent ranges from about 12½° north to 56° south, and from about 35° east to 81° west, covering in that extent seven million square miles or one seventh of the globe. Its area is almost equal to that of North America, but a much larger portion of it is free from barren sections, while its apparently forbidding heated section is far less than the severely cold territory of North America which is not suitable for population. In fact, there is no extensive tropical area in South America which can not hold in large numbers some kind of population. When it is remembered that Java, Siam, the Malay Peninsula, and Ceylon, almost on the equator, contain large populations, it is not difficult to realize how the time may come when the equatorial portion of South America will support large numbers of people.

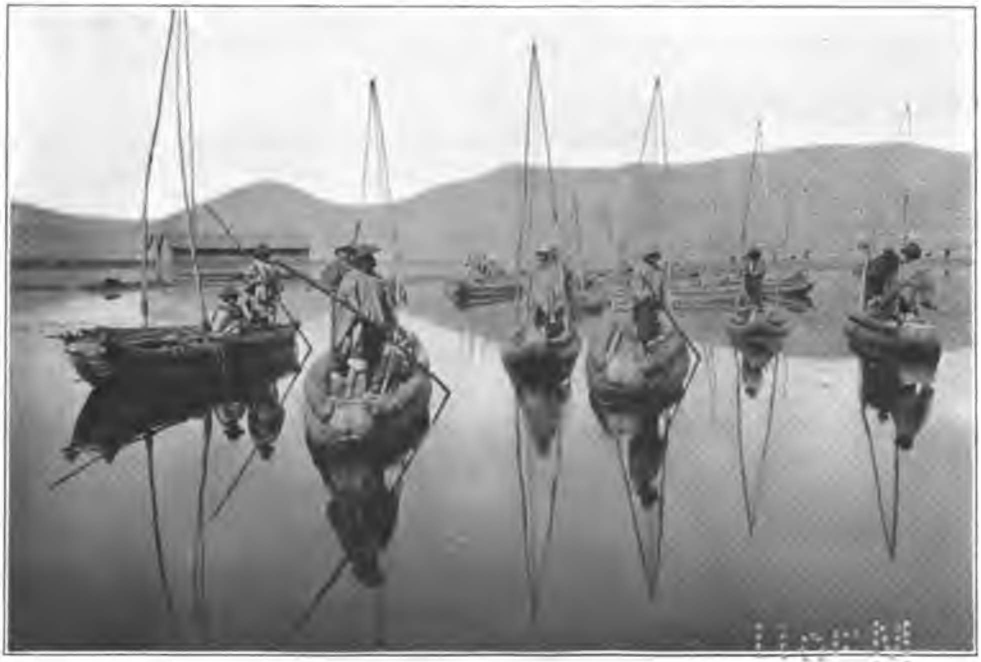
The average man thinks of South America as being a hot country because it is "south," forgetting that nearly all of Argentina, having an area nearly half that of the United States; all of Uruguay, which is somewhat larger than North Dakota; the greater portion of Chile, which reaches for twenty-six hundred miles along the west coast of South America; the prosperous southeastern provinces of Paraná, Santa Catharina, and Rio Grande do Sul, of Brazil, and two thirds of Paraguay, are in the southern temperate zone. These combined could easily support one hundred millions of people where now there are not many more than ten millions. Buenos Aires, the famous and beautiful capital of Argentina, proud of its population of one million two hundred thousand, never experiences the cold or the heat of Washington, the capital of the United States. When, therefore, we consider this characteristic of southern South America, together with the cool plateaus already described, we recognize the potentialities of the southern continent for the development of prosperity and progress.

Perhaps the one geographical feature of South America, which will have more influence on its material development than any other, is its wonderful system of great rivers. The Orinoco in the very northern end, the Amazon in the northern half, and the Paraná in the south, with their extensive branches, provide possibilities of interior navigation and exploitation of vast areas of country which are now inviting the attention of capital and effort not only of South American countries themselves, but of Europe and the United States. There is not space within the limits of this article to discuss carefully the details of these river systems, but it is interesting to note that their mighty volume of water gets its origin through the precipitation caused by the high Cordillera, reaching from Panama south to the Strait of Magellan and lying close to the Pacific Coast, which breaks up the moisture in the atmosphere rushing eastward from the Pacific Ocean. Although the west coast of South America for nearly its entire distance is practically barren of large forest areas or extensive vegetation, and has only such rivers as break through from the heart of the Cordillera, the eastern slope of the Andes, from the northern portion of Colombia south to Argentina, is heavily wooded and frequented with such abundant rains that these mighty streams are never lacking in their supply of water.

The Orinoco, Amazon and Paraná systems are so closely connected, and the height of the watersheds between them is so low, that a patient navigator could start in a canoe at the mouth of the Paraná, 34° south, and by traveling almost due north and picking his way through swampy areas at the sources of these rivers come out at the mouth of the Orinoco at 11° north, or a distance of over three thousand miles. It is estimated on good authority that the Amazon and its tributaries provide channels and canals extending over thirty thousand miles, which are navigable for boats, launches and barges drawing eight feet of water. A little comparison of the Amazon with the Mississippi gives an idea of its navigable features. While vessels drawing twenty-five feet of water have difficulty in getting beyond New Orleans, near the mouth of the Mississippi, vessels drawing thirty feet of water can easily steam up the Amazon one thousand miles to Manaos, and those drawing twenty can proceed another thirteen hundred miles to Iquitos in Peru. This latter town, which can be called the Atlantic port of Peru, is only five hundred miles from the Pacific. River steamers run with ease nearly a thousand miles from Montevideo up the Paraná to Asuncion in Paraguay. The Orinoco is navigable for several hundred miles into the very heart of Venezuela for vessels of sufficient draft to develop a large interior commerce. Few people appreciate moreover, that Colombia, which is nearer to the United States than any other South American country, has a notable stream in the Magdalena, which empties into the Caribbean, flowing due north from the equator and is navigable



Ollantaitambo, Peru. General View.



Balsas on Lake Titicaca, Peru.

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for seven hundred miles for flat-bottom steamers drawing four or five feet of water. There are numerous lesser streams in nearly all of the South American countries, of which mention is not made here, but which are used by the people along their shores for trading purposes and can compare well in depth and length with similar rivers along the coast line of the United States and in Europe.

In view of the tendency of those who have not studied South America to belittle the countries within its limits, it is well to note that Brazil, the largest Latin American nation, covers an area approximately of 3,200,000 square miles; this could contain all of the United States proper from the Atlantic to the Pacific and from Canada to the Gulf of Mexico, and still have room left over for the state of Pennsylvania nearly four times. Its capital city, Rio de Janeiro, has a population of nearly one million and is characterized by one of the most beautfiul and capacious harbors in the world. The comparative area of Uruguay has already been given. Into Paraguay could be placed Pennsylvania twice. Into Bolivia could go Texas twice over and New England once or twice more. Into Peru we could place the whole Atlantic coast from Main to Florida. In Ecuador we could lose Pennsylvania twice over. Into either Colombia or Venezuela we could place both Germany and France. Into the Guianas we could double up New York state four or five times. If the southern end of Chile were placed at the most southern point of California, the northern end of that republic would reach far beyond Oregon, Washington and British Columbia away up into the heart of Alaska. If a plumb line were dropped from the western boundary of Minnesota south to the Gulf of Mexico, the area of the United States east of that line to the Atlantic Ocean would practically represent the area of Argentina.

Before leaving this subject let us remember that the term "South America" is in a sense a misnomer. Perhaps it would be better to call it "Southeast America," for the western tip of South America is just along the meridian that would run between Ohio and Pennsylvania, and the extreme eastern tip of Brazil is on the meridian line more than half way between New York and Liverpool. The Panama Canal is directly south of the meridian running through Erie, Pennsylvania.

If the student of geography has not already investigated South

America, and if he is interested in those sections of the world which possess enormous potentialities and which have not yet received their share of attention, he should devote himself to that continent, for it is undoubtedly entering upon a wonderful era of commercial, material, political, social and educational progress. In this connection I wish to quote as my closing observation a prophecy which it was my privilege to make in an address delivered last October before the Trans-Mississippi Commercial Congress in San Francisco, California, as follows:

"Without unwarranted enthusiasm, let me point out to you my confident belief that the next ten years will be a Latin American decade—that all the world will be then studying and watching Latin America as it now does Japan and the Orient, and that a material, economic, intellectual and political advancement will be witnessed in Latin America which will rival what has been accomplished in the United States. Were it not for the lamentable ignorance which prevails throughout the United States in regard to the peoples, institutions, resources, and governments of this section of America, this statement would not seem in the least surprising. Those of us who have traveled from Cuba to Chile and from Brazil to Bolivia are keenly aware that this great onward movement has already begun and that Latin America has entered upon a new era of splendid activity and world-wide influence.

"Twenty republics, varying in size from the area of Brazil, which is larger than that of the United States proper, to Salvador, the smallest, which would take in Rhode Island six times over, having a combined population of over seventy millions, and a foreign commerce valued at more than two billions of dollars per annum, are going ahead so rapidly that no man can safely prophesy the limit of what they will accomplish during the next ten years. Gifted with a variety of climates and of resources, blessed with a marvelous intermingling of cool plateaus and tropical lowlands, provided with vast navigable river systems, and a long extent of accessible coast line, supplying numerous important products which the rest of the world must purchase, and possessing a people of deep sympathies and high intellectuality based on an old and worthy civilization, they all challenge our best study and keenest appreciation."

AN OUTLINE OF THE ECONOMIC CLIMATOLOGY OF BRAZIL.

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To many of us the name Brazil suggests vast tropical forests, hot and steaming, from out of whose dark recesses forlorn Indians carry immense quantities of precious rubber. It brings up visions of coffee plantations, off somewhere to the south. It recalls pictures that we have seen of the cities of Rio de Janeiro and Santos, which we still think of as pestilential, scourged by yellow fever, or plague. It gives a vague impression of a vast country, little known; of comparatively slight importance; thinly settled by a rather unattractive population, by no means in the front rank of civilization. If we look up some of the more obvious facts regarding Brazil we discover that we are dealing with a country which occupies about one half of South America; which is roughly equal in area to the United States and larger than all of Australia; which, in spite of being sparsely populated, contains 15,000,000 of people; whose resources are vast; whose present economic conditions are of sufficient importance to deserve careful study; whose future is, without a shadow of doubt, of wonderful promise.

There was held, in the city of Rio de Janeiro, during the closing months of 1908, a national Brazilian exposition, designed to commemorate the opening of the Brazilian ports to the commerce of the world (January 28, 1808). The government deemed this a fitting occasion to bring together the evidence of Brazilian progress during the past hundred years. Every one of the twenty states of the republic was represented, as well as the federal district, and the territory of Acre, " that precious piece of land " recently added to the national domain. As one of the newspapers of Rio enthusiastically phrased it, " All the cells of our national organism here palpitate with life, showing the latent force which is impelling us on to the magnificent destiny prepared for our country by a divine providence." To the casual visitor, satiated by visits to the great international expositions of recent years, this Brazilian exposition must have been of little interest. To Brazilians it meant much. It embodied the spirit of their national progress. It gave tangible evidence of what their country is doing, in developing its natural resources; in manufactures; in trade.

On his return, in August last, from a trip across the southern campos of Brazil, the writer spent several days in Rio de Janeiro, and while there, took occasion to make some study of the exposition. So excellent an opportunity to examine, at close range, and within a conveniently restricted area, all the characteristic products of Brazil, has never before been given. Here the rubber, and the tropical woods, and the brilliant feathers from the Amazonian forests could be seen close by the wheat, and dried beef, and wine of the more temperate latitudes of the southern states. Many new points of view came to the writer as he examined the various exhibits, day after day. A clearer, more accurate, more intelligent understanding of the present economic development of Brazil was the first and most obvious result. But the impression which, after all, seems the most vivid and the most lasting concerns the climatic control of the products exhibited at the exposition. This line of thought suggested the preparation of the present sketch of the economic climatology of Brazil.

The purpose of this discussion will best be served if the conditions of Brazilian climates and crops are sketched in the broadest outline. No rigid subdivisions, geographic, political, climatic or floral, are here attempted. It is intended that the reader shall be left with general impressions only; that his mind shall not be burdened with details.

South America is broadest near the equator, and has no high mountains along its Atlantic coast. This fact is of fundamental importance in Brazilian climatology. The broad northern portion of South America, east of the Andes and north of the tropical high pressure belt, is thus freely open to the trade winds. These trades prevail, as a rule, throughout the year, except when the sun is overhead. They are then temporarily replaced by the belt of calms and variable winds. This openness of the continent on the east largely neutralizes the effect of the great extent of the land surface, which would otherwise be characterized by the usual continental effects, and ensures a remarkable uniformity of climate down to near the tropic, with very small temperature ranges. The northern and northeastern parts of Brazil, down to about the latitude of Rio de Janeiro, are within the district enclosed by the mean annual (sea level) isotherm of 80°. The interior, towards the Cordillera, has mean annual temperatures of 75–80°. The southern states have about 65°. The mean annual isotherm of 68°, which is now generally taken as being the most rational boundary for the hot belt (the old "torrid zone"), crosses southeastern Brazil somewhat south of the tropic. The country is, therefore, almost entirely within the equatorial zone, or hot belt. In January, the belt of highest mean monthly temperatures, enclosed by the sea-level isotherm of 80°, covers most of eastern and southern Brazil, and extends into Argentina. In July, the area of 80° is found in northeastern Brazil, covering the lower portion of the Amazon basin. In dealing with the ordinary isothermal charts, it must be remembered that sea-level isotherms do not accurately represent the temperature conditions of a country as elevated as is most of the Brazilian highland.

The average difference between the mean temperatures of the warmest and coldest months (mean annual range) is less than 10° over most of Brazil, and over much of the northern portion, *i. e.*, in the lower Amazon valley and in the northeastern states, it is less than 5°. The seasonal contrasts increase gradually towards the south, especially in the interior. Beyond the tropic they are between 20° and 30°. Along the Amazon the mean annual minima are not far from 60°, but on the plateaus of central and southern Brazil they fall a good deal lower. Temperatures below freezing occur normally every winter over the southern interior from somewhat south of latitude 15° on, and even on the coast, after passing the tropic. In the south, beyond the tropic, frost and snow occur on plateaus of moderate height.

Nature has favored Brazil in supplying abundant annual rainfall over most of its enormous extent. In the northeast, it is true, there is an area of somewhat deficient precipitation. Here severe droughts occur with distressing frequency. Centered over the middle São Francisco valley, at about latitude 10° S., the heart of this district has less than 10 inches of rainfall a year, while the larger surrounding area, roughly between latitudes 5° and 15° S., all has less than 40 inches. The rain-shadow effect of the enclosing mountains sufficiently explains this local peculiarity of deficient rainfall, which is a striking feature on the rainfall map of South America. With this exception, practically the whole country has over 40 inches. The greater portion of the Amazon basin receives over 80 inches, the largest amounts being noted towards the eastern slopes of the Cordilleras. Along the eastern coasts of the highland the rainfall generally exceeds 60 inches, reaching 80 inches and over on the strip between Pernambuco and Bahia, and again on the coast mountains just south of the tropic. Simple also, and easily remembered, is the seasonal distribution of rainfall. By far the larger part of Brazil has tropical summer rains, with a dry winter and spring. The length and intensity of the rainy season naturally varies a good deal in different sections. Much of the Amazon valley has rain pretty much throughout the year, with, in places, short breaks at the solstices, giving something of the character of the double equatorial rainfall type. But on the whole, the distinction between rainy and dry seasons over the Amazonian lowland is much confused. With increasing distance from the equator, to the south, the contrast between the seasons becomes more marked, the rainy season being more distinctly limited to the summer, and the dry season becoming longer and more clearly defined. In southernmost Brazil there is another change, there being a more uniform distribution of rainfall throughout the year: the result of the equatorward movement of the cyclonic storm belt during the colder months. Along the coasts there is more or less rain at all seasons. A peculiar belt, of winter rainfall maximum, is found in the vicinity of Pernambuco. The migration of the belt of equatorial calms and rains explains the season of tropical summer rains, above referred to. There is a drier season while the trade blows, and a rainier season when the equatorial rainy belt is overhead. The trades blow stronger and more steadily in the former; variable winds and calms are more characteristic of the latter.

The great Amazonian lowland is a logical unit, geographically and climatically. Here the uniformly high temperatures[1] and the heavy rainfalls produce those dense primeval tropical forests which many of us probably make the mistake of thinking cover most of Brazil. The name of the great northern state of Amazonas at once suggests forests, and precious woods, and mighty rivers, and rubber—the rubber which is causing so much jealousy about national boundaries in South America; the rubber to secure which men, and women too, are being held in slavery as harsh and cruel, probably, as any slavery ever was in the world. Amazonas is typical of the non-industrial states. It is rich in woods. The exposition at Rio included two hundred specimens of these, ranging from the soft, and light, and porous, to the very dense and very heavy *paô ferro* (iron-wood). The forests, here as elsewhere, are hostile to settlement. They attract only because of the wealth of their products. The towns are located almost altogether along the only possible highways, the Amazon and its main tributaries. The population is sparse,[2] and localized at a few points. The forests are traversed by uncivilized Indians, and by the rubber collectors. There are but few whites, and their numbers will increase slowly. A damp, hot, tropical climate is not well suited to white men and women from colder latitudes. Amazonia is no better, and no worse, than similar regions elsewhere. With proper precautions, choosing suitable dwelling-places and living temperately, white men from the north may reside here with a fair chance of good health, but acclimatization, in the full sense, is impossible. We need not expect any considerable influx of Anglo-Saxons. Those who do come will be overseers, not laborers. They will direct, not do, the hard work. They will constitute a small upper ruling caste. The Latin race, which succeeds better in the tropics than the Anglo-Saxon, will always predominate among the white population. Malaria has been, and still is, the principal barrier in the way of exploration and settlement by white men in the interior. But, as elsewhere in the tropics, endemic diseases are due more to the neglect of proper sanitary precautions than to the climate. The healthiest places are the higher portions of the lowland.

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[1] The temperatures at Pará and Manáos (130 ft.) are typical. The mean annuals are 78.4° and 78.8° respectively. The means of the warmest and coolest months are 79.5° and 79.9° and 77.7° and 77°. The mean annual ranges are therefore 1.8° and 2.9°. The diurnal ranges are considerably

The increasing value of rubber will lead to a further immigra-

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larger than the mean annual. Thus, at Pará, the former is a little over 16°. The natural division of the year is, therefore, not according to temperature, but depends on rainfall.

[2] About 600,000 in the two states of Amazonas and Pará.

tion into the Amazonian forest lands; to the constructing of railroads; to the general development of the country. But all this will take place under great climatic handicaps. It is impossible even to hazard a reasonable guess as to when the natural (wild) rubber supply will be exhausted. There are still vast untouched reserves. But unless a substitute is found, the time will come when plantations of rubber trees must be undertaken. The future of Amazonia, as far as we can now see, is likely to be chiefly dependent upon rubber, as it is to-day. So important is this rubber that we easily forgot that Amazonia is rich in other natural products. Besides the remarkable variety of woods, the forests supply cocoa, Brazil nuts, vanilla, sarsaparilla, coca, dyes. So far there is only the merest beginning of agricultural development. Along the lower portion of the main stream there is a belt of cocoa plantations, and some manioc, corn, rice, cotton, tobacco, sugar-cane and bananas are raised. Where the forests are broken by grass-lands, there are more settlements, and cattle ranches. With increasing settlements, more farming will be undertaken, but the dense tree-growth is the natural product of soil and climate. It stands as a barrier. It can only be cut down, and kept down, by a continual struggle. Crops, raised for local consumption, may be expected to increase in variety and value, but for export the forest products, either wild or cultivated, will doubtless remain far in the lead. Moreover, it must be remembered that, in time of high water, floods cover an immense extent of the country, forcing men and animals to migrate, or to seek elevations which are beyond the reach of the swollen waters. Some of the natives even live for a season in boats. At such times the Amazon basin becomes, in places, a great waste of waters: the tributaries unite in an intricate system of canals and lagoons. For miles and miles the forest trees stand deep in water. The *terra firme,* above the flood level, is alone suited for permanent settlement: the lower parts are swamps. These periodic overflows make it impossible to use for agriculture much of the low-lying alluvial land.

The forests of the damp, hot lowlands of the Amazon gradually merge, on the south, into the open woods and grass-lands of the drier and somewhat more temperate climates of the Brazilian highland. The great part of this highland is composed of undulating plateaus, with an abrupt descent to the Atlantic and a more gradual slope to the basins of the Amazon and Paraná systems. The average elevation of these plateaus is about 3,000 feet, and seldom falls below 2,000 feet. The tropical forests penetrate into the highland along the deep valleys of some of the large southern tributaries of the Amazon, and appear also on the upper Paraná, in the São Francisco valley, and along the coast ranges of mountains. The northern and northeastern portion of the highland is largely covered by the open *caatinga* ("white woods") forests. These are lighter, and lower than the tropical forests; the trees are farther apart; they shed their leaves in the dry season, and present a wholly different aspect from that of the Amazonian forests. Over a great area south of the *caatinga* zone, and interrupting it greatly in places, come the famous grass-lands, or campos, which, without very much change in general appearance, stretch on across state after state, into southern Brazil.

Campos, not dense tropical forests, are characteristic of most of Brazil. Perhaps three-quarters of the country are occupied by these wonderful rolling plains, here stretching as far as the eye can reach without other vegetation than tall tufts of coarse "goat's beard" grass, perhaps interspersed now and then with large brakes or stemless palms, arboreal cacti, or mimosas (*campos abertos*); here sparsely covered with scattering, scrubby, gnarled trees, giving an appearance much like that of an old apple orchard whose trees are dead or dying (*campos cerrados*); there again covered with a dense growth of trees and shrubs, all entangled with vines and creepers, and covered with long gray moss ("old man's beard"), or again, having a park-like appearance, with isolated clumps of trees ("islands") dotted over the grassy plain. Monotonous these Brazilian campos certainly are. They are vast. They are grim. But the monotony becomes variety to the observing traveler who catches the spirit of the place; who notes the change from open country to woodland, and from woodland to the sparsely-treed sections. There is infinite variety in the constant change of color; in the succession of forest and field; in the shifting cloud-shadows and bright sunlight. Very striking are the sudden transitions from open campos to dense forest; as sudden as if due to human agency, but in reality the work of nature or of fire. Fire has had much to do in determining present conditions on the campos. As one travels across these stretches by train or horseback, the blackened fields and bare tree-trunks furnish abundance evidence of the work of fire. In the dry season, scarcely an hour of the day or night passes without revealing the smoke or flame of a fire in progress—a fire which may have been burning for days.

The Brazilian highland includes a vast area, over which differences of rainfall, temperature, soil, exposure, water-supply, settlement and transportation naturally vary more or less. Hence there are also considerable differences in economic conditions; in the degree of development; and in the future possibilities of the different sections. To go into details is out of the question in the present paper.

The states of Matto Grosso and Goyaz occupy the more elevated western and central portion of the highland, averaging 2,500–3,500 feet above sea-level. They are typical campos country, the grass-lands passing into tropical forests in the valleys and on the northern slopes, towards the Amazon.[8]

In winter the temperatures occasionally fall below freezing on these plateaus, so that ice may form, and the crops may be frost-bitten. There is a well-marked tropical (summer) rainy season, with many thunderstorms, between October or November and April or May. Then the campos are fresh and green. The winter dry season, roughly between April and October, dries up the grass-lands, which are then bare and unattractive. In central Matto Grosso the drought is often very marked: in some years not a drop of rain falls from June to August. In the north, the rains are heavier and begin earlier. The prevailing winds of winter are the southeast trades, and at this season the climate of the plateaus is most agreeable. In the summer the winds are north and northwest, and variable.

This whole central portion of the Brazilian highland is very thinly populated. Especially is this true of Matto Grosso, much of which is practically unexplored. To the Rio exposition Matto

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[8] Cuyaba, 720 feet, latitude 15.5° S., on the upper Paraguay River, is the most important center, and also furnishes the best meteorological record. The elevation of this station is, however, lower than the average altitude of the campos. With a mean annual temperature of 77.5°, its warmest month averages 80.6° and its coolest, 69.4°. This gives a mean annual range of about 11°. Uberaba, in southern Minas Geraes, with an altitude of about 2,500 feet, is more typical. Its mean annual is 70.3°; the coolest month (July) has 64°; and the warmest (February) has 74.1°. The mean annual range is thus 10°.

Grosso sent specimens of its agricultural products in sugar, and farina, and rice, and corn; of its spices and herbs; of its woods, including the famous *quebracho,* and showed, by means of photographs, some of its great herds of cattle, of which it has now about 3,000,000 head. This immense western state is very rich in promise for the future. It is hampered, as all these states are, by lack of good means of communication. The trails across the campos are bad at their best, and in the rainy season they become almost impassable swamps. The construction of the proposed new railway line, which has recently been surveyed across Matto Grosso, to connect the railroads of São Paulo on the east with those of Bolivia on the west, will mean a greatly increased opportunity for development. In horses, mules and cattle, Matto Grosso will doubtless find its best future. Coffee has succeeded well in the southern sections, and might be further developed.

Two great states, Minas Geraes and Bahia, occupy the eastern central portion of the Brazilian highland. The former is one of the most populous states in Brazil. It is entirely inland, but its eastern margins are reached by railroads from Rio de Janeiro and São Paulo. The surface, generally high and mountainous, is covered with forests and typical grass-lands. The name, Minas (mines), indicates at once the chief source of wealth. In climate, Minas is similar to its neighbors, Goyaz and Matto Grosso, on the west. Hail is not uncommon; killing frost may occur; ice forms occasionally, and snow has been reported at Ouro Preto. But reasonably high, and uniform, temperatures are still the dominant characteristic. At the Rio exposition Minas Geraes was represented by its famous cheeses, made from the milk of the cows pastured on its great campos; by its gold and diamonds and precious minerals, and by a fine model of its famous Morro Velho mine. Many cattle are being raised in Minas, and agriculture is making a good start in the south, where European vegetables, fruits and cereals are being raised, and conveniently shipped by rail to the neighboring large cities. Bahia, in its northern interior, shares in the decreased rainfall which as already noted, characterizes a portion of northeastern Brazil. The *caatinga* forests, which penetrate into the campos from the north, merge in places into the *sertâo,* which is essentially a desert in northern Bahia.[4]

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[4] Santa Anna do Sobradinha (latitude 9° 26′ S.; longitude 40° 47′ W.,

Even the coast sometimes shares in the dry seasons of the interior. The inland portions of the state are successfully used for stock-raising, while the rainier coast,[5] with fertile soil (*massapé*), supplies abundant crops of sugar-cane, cocoa and tobacco. Rubber, cotton (chiefly from the drier portions of the interior), and coffee are also exported.

A group of small states in northeastern Brazil differs a good deal, in climate and products, from the southern states.[6] The annual rainfall is actually deficient over a comparatively limited area, but the dry season is long and hot. In Ceará especially, and also in Piauhy and Pernambuco, droughts are a serious climatic handicap. There may be an almost complete failure of the rains; vegetation dries up; cattle perish; the inhabitants fly to the coast cities. If a severe drought occurs in two or more successive seasons the results become disastrous. It is reported that in 1878, 25,000 refugees died in the city of Fortaleza (Ceará). These droughts have something of a rough periodicity in their occurrance. The dates of the most serious ones were 1792–96; 1808–09; 1816–17; 1824–25; 1844–45; 1877–79; 1888–89; 1898. At times of severe droughts, whole inland districts are abandoned. Recently the government has undertaken irrigation works in Ceará, which it is hoped will mitigate the evils of these extreme dry spells. In northeastern Brazil the *caatinga* forests attain their best development, but alternate, here and there, with open grass-lands. The latter here extend locally all the way to the coast. The change from the damper climate of Amazonia to the drier climate of northeastern Brazil is reflected in the crops of cotton, tobacco, sugar-cane, corn, rice and manioc which are characteristic of these states. Coffee is an unimportant crop. Cocoa does well on the damp lowlands of Maranhão and Piauhy. Cotton is one of the chief exports from Pernambuco. And the interior, in spite of the occa-

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altitude about 1,000 feet), in a protected location on the São Francisco River, about 500 miles from the ocean, has less than fifteen inches of rainfall a year (in summer). Its warmest month averages 82.6°, and its coolest, 74.8°.

[5] Bahia has an average of over eighty inches a year.

[6] At Pernambuco the mean annual temperature is 78.4°; the mean of the warmest month, 81.7°; that of the coolest, 73.8°. The mean extremes are 97.5° and 64.6°. Fortaleza has a mean annual of 79°; a mean for the warmest month of 80.6°; for the coolest, 77°. The mean annual range is therefore only 3.6°. The ranges in the interior are somewhat greater.

sional droughts, has proved a good country for stock-breeding, the salt deposits of the more arid portions forming an interesting contribution of the climate to the success of the cattle industry. The *salinas* of the São Francisco valley are well-known, and from them salt is exported. Grass-lands or *caatinga* forests on the whole cover the interior, while the rainier eastern districts support denser tree-growth.

East of Minas Geraes we have the two littoral states of Espirito Santo and Rio de Janeiro, and south of Matto Grosso, Goyaz and Minas Geraes we have the great southern states of São Paulo, Paraná, Santa Catharina and Rio Grande do Sul. These southern and southeastern states form the present political, economic and industrial center of Brazil. Along the ocean the tableland is high, with mountain ranges and valleys running parallel with the coast. The interior is a rolling plateau country, with the famous Brazilian campos in their most typical development. Between the Atlantic Ocean and the Paraná River, south of Minas, there are four very important states, separated by tributaries of the Paraná; sloping gently inland and westward; falling off abruptly to the sea on the east. The names of these states are well known to all who have more than a very superficial knowledge of South America geography. On the north is São Paulo, bordering on Matto Grosso, Minas and Rio de Janeiro; mostly within the tropics; famous for its marvellous production of coffee; for the rapidity of its economic, industrial and intellectual development; for the remarkable extension of its railway system, which is due largely to the importance of the coffee crop; for its large German and Italian immigration. In its coffee production São Paulo has far outstripped, not only the rest of Brazil and of South America, but all the rest of the world as well. São Paulo is the ideal place for coffee plantations. The famous *terra-rossa* (red soil), celebrated for its fertility, is adapted for the growth of coffee as no other soils seem to be. Here, on the slopes of the hills, at elevations of 1,500 to 2,500 feet, in moderately warm locations, where there is sufficient rainfall for the growth of the plant and a dry season favorable for curing the berry, coffee finds conditions phenomenally well suited to its successful cultivation. Coffee is raised in Espirito Santo and in the state of Rio de Janeiro, but São Paulo is the coffee district *par excellence*. The coffee plant was introduced into São Paulo and

Rio de Janeiro in the year 1761, and the success of this crop has made this section of Brazil the economic center of the country; has made coffee the staple production of Brazil, and has led to the development of a more extended railroad system than is found in any other part of the republic.

Whoever thinks of Brazil thinks of coffee, and whoever thinks of coffee-production in Brazil thinks of the state of São Paulo. In the São Paulo exhibit at the Rio exposition the visitor could see bag after bag, and sample after sample, of coffee, of all grades, varieties, qualities, prices—confusing, monotonous, if you will, but very instructive. A large diagram, hung on the wall, showed the export of coffee from Brazil in the year 1906–7. The total amount exported was 20,190,000 sacks of 60 kilograms each. Santos, the world's greatest coffee port, exported 15,392,000 of these sacks. All countries outside of Brazil exported only 3,595,000 sacks. In this diagram these various amounts were represented by small coffee sacks, and each of the sacks of the diagram really represented 50,000 sacks of 60 kilograms each! Whether the traveler to Brazil can manage to get into the coffee district or not, he should surely not fail to see Santos. As the steamer comes up to the city through the narrow channel, winding about through green fields, one wonders where this famous coffee port is, of which every one has heard so much. You see some houses in the distance, very unattractive to the eye, and are told that that is Santos. Your surprise continues to grow until, on making a final turn in the river you see, stretching out on your left, the famous Santos docks and warehouses, with steamers of all sizes and of many flags, lying two deep in many cases, the whole length of the docks. Everybody is busy. Teams, and mule-carts and donkey-engines and traveling cranes and porters—all busy loading coffee. Coffee is everywhere: in the streets, in the stores, on the train. If coffee is injuring the human race, Santos is doing its best to accomplish that purpose.

The climate of the interior campos of São Paulo and Paraná (average elevation about 2,500–3,000 feet above sea-level) is continental, with the modifications due to altitude. It is cooler and less humid and more desirable in every way for European immigrants than the seacoast, or the campos of the more northern states of Brazil nearer the equator. It is therefore natural that Europeans have settled so largely in the southern states, and it is inevitable that these states will become the most important, industrially and economically, in the country. The climatic conditions will bring about that result. The campos of southeastern Brazil unquestionably have a winter climate which deserves the praise it has generally received from those who know it. Clear or fair days, with a strong diurnal range of temperature, were the dominant weather type in the latter part of July and early in August, 1908, when the writer crossed the eastern portion of the campos of São Paulo and Paraná. The fresh, crisp, cool air and cloudless skies of early morning are succeeded by a warm noon and early afternoon, with fresh southeast winds showing a distinct diurnal variation in velocity, and with a considerable development of cumulus clouds. The direction of the prevailing wind (southeast) is clearly shown by the unsymmetrical growth of trees in exposed locations. Toward sunset the temperature begins to fall rapidly; the clouds dissolve, and clear, or perhaps foggy, nights follow, with light wind or a calm. During winter nights, even in the northern part of the state of São Paulo, frost is by no means uncommon, and the coffee plants are liable to injury on that account. For this reason, they are planted on the slopes of the hills, and not usually on the lower ground. The writer saw banana trees frost-bitten in a valley bottom in São Paulo at an elevation of about 2,000 feet above sea level. Farther south, owing to the increasing danger from frost, the coffee is planted at greater elevations on the hillsides. In Paraná, the minimum winter temperatures are a few degrees below freezing, and occur on nights following rains and southwest winds. During fine weather in winter the conditions are ideal for health and pleasure.[7]

The rainfall on these campos is at a maximum in summer (usually October–March), but rains are not wholly absent in the so-called "dry season." These are both general cyclonic rains, and thundershowers. The latter are not infrequently accompanied by hail. Heavy rainfalls wash the roads badly, and make travel difficult.

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[7] The climate of the city of São Paulo (altitude 2,430 ft.) is generally highly commended. The mean annual temperature is 64.8°. The warmest month has a mean of 71.4°; the coolest, 57.2°. Temperatures below freezing have been recorded. Thus there is only moderate heat in summer, and no severe cold in winter. It comes near to being a "perpetual spring" climate. At Tatuhy (altitude about 2,000 ft.), the mean annual is 65.8°; the mean of the warmest month, 73.6°; of the coolest, 57.4°. A minimum of a little below freezing has been observed. As one enthusiast has expressed it, São Paulo has all the charms of a tropical sky without any disagreeable heat.

Curityba (lat. 25° 25′ south, long. 49° 15′ west, altitude about 3,000 feet), the capital of the state of Paraná, well illustrates the winter climatic conditions of the southern part of the campos where the writer crossed them. At this place the maximum temperatures of early August were not far from 70°, while the minima fell to 45° or 50°, and sometimes lower. The prevailing winds were northeast and southeast; the relative humidity about 80 per cent. No rain fell during the writer's stay in Curityba, but the winter months are by no means rainless, July and August having mean rainfalls of 2.48 inches and 3.81 inches, respectively. The days were fine, with a predominance of cumulus clouds; and the diurnal temperature variation was very marked, with cool mornings and nights and warm afternoons. Nocturnal radiation fogs are evidently common in winter. The prevailing winds in the dry season are southeast. In the rainy season they are variable, and more northerly and northwesterly.

South of about latitude 20° the more or less characteristically tropical types of vegetation undergo a change, except along the coast, and a belt of transitional forms is entered upon. Coffee is preeminently the product of eastern Brazil, but there is also some farming, especially in São Paulo, European vegetables, as well as manioc, corn, beans, bananas, oranges, etc., being raised. Sugar-cane is found on the warmer lowlands; cocoa does well on the damp coast of Espirito Santo; tobacco is raised in the north. The interior campos are being more and more used for stock-raising. The region crossed by the writer in São Paulo and Paraná is to-day very sparsely settled. A few small towns, at great distances apart; occasional scattering fazendas (ranches), or small huts built of adobe or wood, separated often by tens or twenties of miles—that is the present condition of occupation by man. Herds of cattle, horses, mules, and hogs are occasionally seen scattered over the immense stretches of open fields. Here and there, around the towns or where some settler has placed his lonely cabin, a little rude cultivation is attempted; some beans, manioc, and corn are raised, and where conditions are favorable, bananas, oranges, sugar-cane or rice may be seen.

(*To be continued.*)

THE RIVER PLATE REGION AND ITS POSSIBILITIES.

DR. ALBERT HALE,
International Bureau of American Republics.

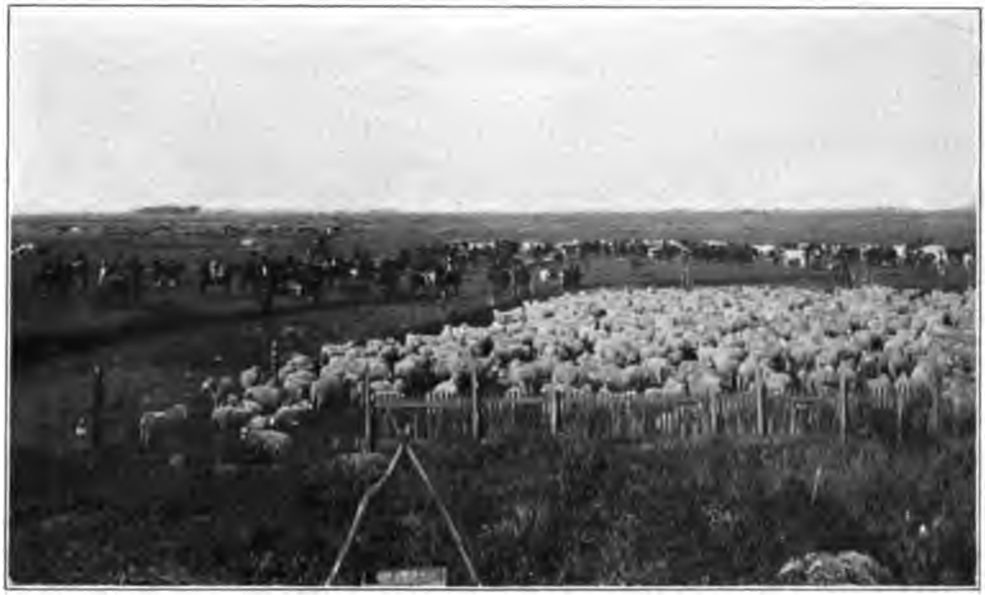
South America can be broadly stated to consist of three great geologic subdivisions. The Andean chain, running from the southern tip of Chile to the extreme northern shores of Colombia and Venezuela, is the most conspicuous and the most easily studied of these. Many of the volcanoes here are still active, and the rocks and minerals offer objectively a clear story of their formation. The vast valley of the Amazon is the second. Here, although traces of volcanic struggles come at intervals to the surface, as the recently published notes of Spruce record confirmatory evidence, the history is more hidden, the growth of the earth less patent, and the work of studying this formation is beset with difficulties. Certain economic features attend these geologic conditions. The Andes gave their metals to the world long before the Spanish conquest, and it is probable that for generations to come the source of much of the world's wealth of similar kind will be derived from here. This does not overlook the wonderfully rich and productive valleys of Chile, nor the plateaus of Bolivia, nor the eastern watershed in Peru, Ecuador and Colombia. It merely indicates that the dominant factor in the wealth of these areas is mineral, not agricultural. In contrast thereto, the Amazon has inestimable productive capacity in rubber, cacao, timber, and similar gifts of nature, but no one can foretell how soon or under what conditions this region will be reclaimed for man's habitation and food supply.

The third great geologic subdivision of South America may be called the region of the River Plate. This embraces a large part of the interior of Brazil, all of Paraguay and Uruguay, and the upper portion of Argentina. The lower half of this last named republic, although it is independently drained into the Atlantic Ocean, does not differ materially from the rest, and should be considered as a part of it.

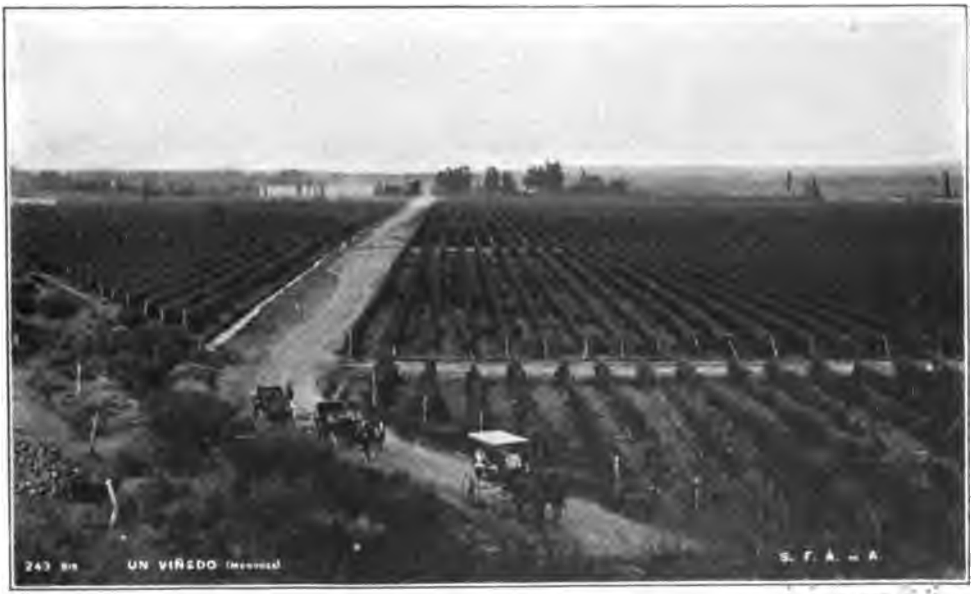
The Ancient Pampean Sea is the descriptive title given to the area mentioned. This was the basin from which the original La Plata received its water to pour into the ocean. And it was a still mightier river in those times! Estimates place it even greater than the ancient Amazon, and well up to the modern Amazon, for the latter river discharges over 5,000,000 cubic feet a second, a much stronger flow than formerly, while the ancient La Plata must have had a maximum discharge of 4,000,000 cubic feet per second. This old lake was, by the advance of the ages, filled by the silt washed down from the slope of the Andes, and the western edge was permanently strengthened as a barrier by a gradual uprising. On the east a process of erosion took place as the waters, seeking an escape from the moderate plateau bounded by the Sierra of the Brazilian coast, found outlet also through the Parana basin, and where they rushed with increasing volume toward the southwest, they gashed a way to the inland sea down what are now the Falls of the Iguazú, the Guayrá and the Uberaponga, considered by those fortunate enough to have visited them equal in power if not altogether in grandeur, to Niagara.

The filling of this lake was therefore not a volcanic action, but one of slow and positive growth. It is even yet going on, and within quite recent historic times the tip of the River Plate has receded, and now, according to maps in the possession of the Library of the Minister of Public Works of the Argentine Government, the delta is much closer to the ocean than it was when the river was first navigated.

The River Plate is but the estuary of several river systems. The nearest tributary is the Uruguay, which forms the boundary for much of its course between the republics of Uruguay and Argentina; it comes in from the north and east, and is a strong body of water, comparable to the Tennessee. The greatest tributary is the Parana; this river rises in the tropic highlands of Brazil, and becomes a stream of the first class, with a season's rise and fall of twenty feet and more, as it passes through Argentine territory. Another tributary, but in reality a branch of the Parana, is the Paraguay toward the north, which passes from the mid-lands of Brazil, at one place only a few miles from the headwaters of part of the Amazon basin, through the republic of Paraguay. A fourth, and but little known river, is the Pilcomayo, forming the boundary between Argentina and Paraguay, and draining from the Bolivian



Auction Sale on a Ranch, Province of Buenos Aires.



Vineyard in Mendozoa, Argentine Republic.

plateau on the northwest. Other rivers add to the volume of water poured into the Parana, but those mentioned show the immense area of the basin which, by the nature of the ground, contributes to the region of the River Plate.

This La Plata has a mean average discharge 80 per cent. larger than that of the Mississippi, the former being about 288 cubic miles, and the latter 156 cubic miles. Its drainage basin measures 1,200,000 square miles, one third the size of the United States. This includes a portion of Brazil and Bolivia, all of Paraguay and Uruguay, and about one half of Argentina. To this add part of the lower half of Argentine territory, and we have an area of 1,500,000 square miles of alluvial land which already is, or in time will be, brought into agricultural or pastoral use for man.

It must be remembered too that this is by no means a tropical country. Buenos Aires and Montevideo, the natural and improved seaports profiting by the commerce of this region, and situated about at the center of the north and south line, are on the same parallel and enjoy the same climate as Los Angeles and Charleston, in the United States, or of Melbourne, Australia, and Capetown, Africa. Asunción, the capital of Paraguay, is 950 miles north of these cities. The southern limit of Argentina corresponds to Labrador and Kamtchatka, but the climate represents rather that of the northern United States. In longitude the mouth of the River Plate is slightly east of Nova Scotia, and a straight line can be drawn from it to Liverpool; the western boundary of Argentina corresponds to the longitude of Augusta, Maine. Only the extreme northern tip of the whole area is actually between the Tropic of Capricorn and the equator, and therefore nearly every square mile is susceptible of just such productive activities as we, in the United States, understand and have, within broad limits, put into practice. Of the above-mentioned million and a half square miles, 1,366,000 belong to Argentina, 158,000 to Paraguay, and 72,000 to Uruguay, the remainder, although industrially contiguous to the River Plate, are politically parts of Brazil and Bolivia. As a matter of fact, only one tenth of this can be said to be at present touched by cultivation, but, examined as to future possibilities, it can be conservatively stated that one third is forest and river land, one third is suitable to pasture, and one third will be given to agriculture.

Two subdivisions of Argentina must be brought to notice. One is to the west, lying against the eastern base of the Andes and at a much higher elevation than the rest of the country. This region partakes of the climate and productive characteristics of the adjacent portion of Chile; here are found the greater supply of whatever minerals the country can boast, the vine, and other products of the mountains. When this ridge was upheaved in some spasm of nature, the western boundary against the Pampean Sea was established, and when man set a limit to the ambition of one nation against another, Argentina secured possession of her share, but geographically it is distinct from the lower drainage basin of the River Plate. The second is the relatively unsettled section south of the deep indentation of Bahia Blanca. Only a few years ago this was the mysterious Patagonia, full of gigantic Indians, mysterious bipeds and analogous horrors, but to-day it is about as wild as the Panhandle of Texas, and migration is as rapidly tending that way as it is toward our own unreasonably maligned Bad Lands. Although the soil is to a great extent alluvial, some features of the country are volcanic, and the width is so narrow that no great distinction can be made between the two geologic formations. Certain it is, however, that much of the land, once called "cursed" by so eminent an authority as Darwin, is susceptible of civilization.

Commercially and industrially speaking, this discussion of the geography of all this area has a markedly practical bearing upon the present character and future probabilities of the country. In the first case, the foreign commerce is great, but it is bound to develop into something much greater, and prophets of clearer vision than I have declared that the region of the River Plate will be one of the foremost granaries of the world before the middle of this century. It has been estimated that the world's stock of wheat will be behind the demand for it made by an increased population, in 1931, and the region of the Ancient Pampean Sea can grow wheat for 100,000,000 people. But better still, this wheat can be gotten to market with greater expedition and less cost than from any other similar acreage. Every section of the food-producing belt of the Plate is within 500 miles of ocean transportation. Even Asunción, 1,000 miles from the Atlantic Ocean, can load foreign steamers at her docks; Corrientes, in Argentina, partakes of the same commerce, but when contemplated plans are carried out, both of these cities will be able to accommodate European liners of modern draught and tonnage. Already Santa Fe, and Rosario 225 miles above Buenos Aires, have direct ocean navigation, Rosario being equipped with modern docks, elevators and tracks which allow of immediate loading from the farm to the vessel. The channel when finally dredged thus far up the Rio de la Plata and the Parana will have a depth of nineteen feet to Santa Fe and of ten feet to Corrientes and Asunción.

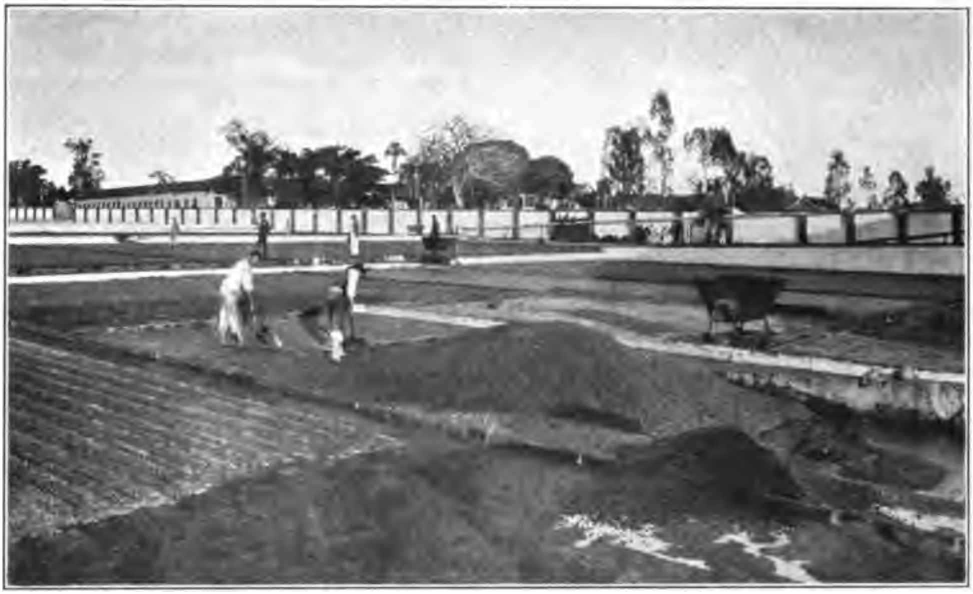
The Uruguay River, forming for some distance the boundary between the Republics of Uruguay and Argentina, is already navigable to Concepcion, but the channel will as soon as possible be deepended so as to accommodate ocean steamers of a draft of nineteen feet.

This splendid fluvial system, actually in use or susceptible of future development, is directly the result of the geographic configuration of the Ancient Pampean Sea. The deposits brought down during the ages have given a crust of fertile soil over the larger extent of the drainage basin, and when the demand arises, the products from the east, north and west, from the temperate regions of Uruguay and Argentina, as well as those of the extreme high latitudes and plateau lands of Brazil and Paraguay, will be easily exchangeable for everything needed from the factories of America and Europe.

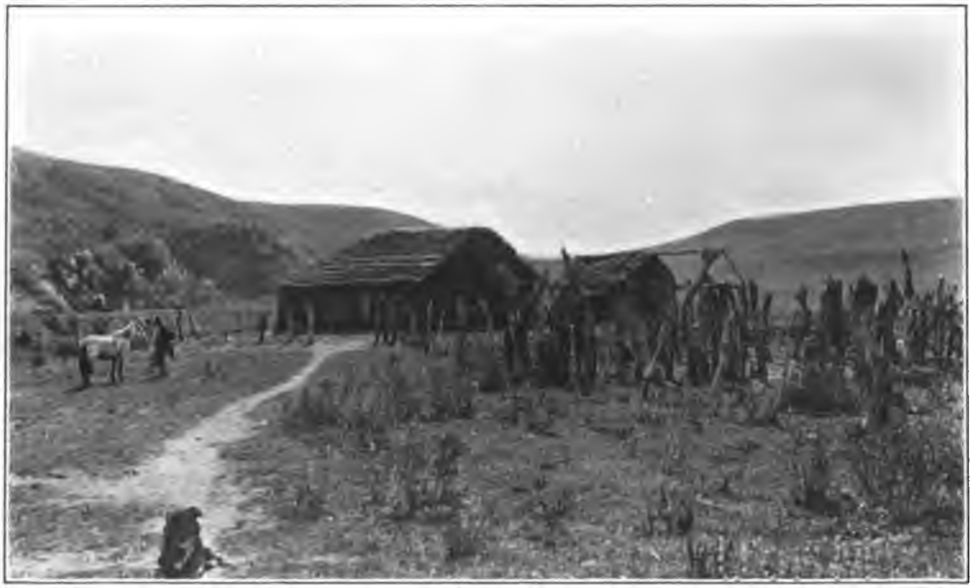
In addition to the great river, Argentina and Uruguay have other ports from which their increasing commerce can be shipped abroad. Some are natural harbors, requiring but a moderate outlay to make them approachable and safe, others are as yet not much more than roadsteads, to be rendered secure only by artificial means. All, however, are free from the dangers and difficulties pertaining to a rocky, precipitous coast. When, therefore, the increase of productivity demands such channels of commerce, they will be supplied, all the way to the Strait of Magellan.

If nature, in her bounty, has been thus generous to this portion of South America, it is equally true that in the interior the geographic formation is admirably adopted to the economic needs. On the immense pampas of Argentina is the longest stretch of absolutely straight railway track in the world—over 175 miles—and if the engineer in building it had had this aim in view, he might, by avoiding an insignificant and unnecessary curve, have added 70 miles more. This was but following the lay of the ground. The thirteen thousand miles of railway in Argentina, the thirteen hundred in Uruguay, have been the results of the economic advances of the country. They presented no difficulties of construction, and the marvellous feats of engineering seen in Brazil, Peru, and other parts of Latin-America, were not required. The land lies flat; here and there are streams to cross, and on the Parana floods have offered such obstacles that the system of ferries has been adopted—the first car ferry in South America having been operated, a distance of 37 miles, across that river; here and there are hills, but only such as those with which we are familiar in Iowa or perhaps Massachusetts. It is only when the foot of the Andes is reached that mountain climbing like that in the Alleghenies and Rockies is a factor in railroading. Then, indeed, the engineer's art is taxed, and beautiful results are accomplished. The Pass of the Andes, used in through travel between Argentina and Chile, is sublime both as a fact of nature and of art. When the tunnel, still building to connect the two ends of the railway—this will probably be finished in 1910—is in use, the passage from ocean to ocean can be made in forty hours and all phases of South American landscape and geography will be objectively presented by this trip.

The statement that every foot of soil of this immense area of the southern continent was within five hundred miles of navigation was no slip of the pen. It can not be denied that Asunción and the upper reaches of the Alta Parana are 1,000 miles above salt water, but even now much of this region is accessible to steamers coming from abroad up the river, and when the channel improvements are completed, a shorter haul than the above maximum will place all produce in cargoes for any part of the world. Jujuy, also, the best known station in Northern Argentina, is 1,000 miles from Buenos Aires, but it is much less than that from the Pacific Ocean, and it will not be many years until a haul of less than 500 miles across the Andes will find a shipping port on the Pacific Ocean. Again, the newer railways, extending toward the southwest into the once despised Patagonia, lead, over the traveled highway, to Buenos Aires. This may measure more than 1,000 miles, but to the newer port of Bahia Blanca the distance is less; over the Andes, by almost the first surveyed line across the continent, the distance is much shorter to the Pacific, while to Punta Arenas, the growing free



Terreiro com café, Sao Paulo, Brazil.



Ranch Scene in Uruguay.

port of Chile on Magellan Strait, the haul will be about 500 miles either way.

The problem, in this part of the world, has been to get the increasing products of the soil to market; how successfully it has been met may be judged by the fact that Argentina's foreign commerce has averaged upwards of $100 per capita, a greater commerce than that of any of the large exporting nations. Commerce, however, has only followed productive industry. The latter as well as the former has been singularly favored by the geologic conditions existing in this particular portion of the world. When the Spaniards discovered the land, they had hoped, as the names of the country and river indicate, to unearth the precious minerals; they found, however, a nearly unoccupied region, awaiting after a preparation of thousands of years some one to take advantage of nature's good will. At first these luxuriant pampas were used for cattle; even yet the production of cattle and sheep is enormous. Not so very long ago cereals were introduced. Scarcely a generation back the River Plate imported wheat for its bread, while today the wheat exports from this region place it among the great producers of the world. To wheat has been added corn, linseed, alfalfa and barley. Everything will grow on this rich soil. Pastoral industry is slowly giving way to the cultivation of cereals, as is the case in Texas, but the area suitable for each is so vast that it can hardly be estimated, and when modern intensive agriculture is once applied, as we think if it in Pennsylvania and Kansas, the total of the crops will be enormous.

Cereals and cattle are by no means all, however, which this region will produce. There is cotton, the grape, all the fruits from apples to oranges, and sugar. In the north nature has provided many hard woods, in the south the pine. Man himself could not have combined the soil, climate, drainage and accessibility with greater kindness, had the creation of the world lain in his power. The United States has been called by the Germans, "Das Land der unbegrenzten Möglichkeiten," South America has an area, also one third the size of the United States, with commensurate productive possibilities. Its geographic formation has contributed remarkably to its economic condition, and the energy of man may be counted on to do the rest.

THE DISTRIBUTION OF POPULATION IN BOLIVIA.

ISAIAH BOWMAN,

Assistant Professor of Geography, Yale University.

Bolivia is frequently spoken of as the Switzerland of South America, but Switzerland's heights and not Bolivia's are flattered thereby. The high plateaus and the mountains of Bolivia are more correctly, if less picturesquely, described as the roof of the western as the Pamirs are the roof of the eastern world. A mountain peak map of South America showing all the peaks above 12,000 feet in elevation would have to be made in solid color over an area representing thousands of square miles in Bolivia and Peru. In both Switzerland and the other well-known mountain countries of the world the greater part of the population lives at comparatively low elevations in the valleys among the mountains. In the Alps, the population is distributed at elevations only a fourth or a third as great as the population of Bolivia. The "stavoli" or chalets of the Alps, in the region described by Professor O. Marinelli[1] (the extreme upper basin of the Piave), used in the spring and autumn and occasionally also in summer as sleeping places, occur at a mean height of 4,650 feet, or only 300 feet greater than the permanent habitations. Barns for hay storage reach a mean altitude of 5,530 feet; while the communal cattle-stations used only during the summer extend to but 5,750 feet.

In Bolivia, on the other hand, about 72 per cent. of the total population live at an altitude of 6,000 to 14,000 feet above the sea, and temporary habitations in the mountains and plateaus are often found at 15,000 and 16,000 feet.

To understand the geographical distribution of the mountain ranges, the passes, the routes of travel and trade, the climate, the products, in short every geographic element that reacts upon the people who dwell in the higher regions of Bolivia and Peru, one must appreciate the fact that the Andes are not a line or lines of peaks, nor of meridional ranges, but a group of lofty, upwarped plateaus. The surfaces of these plateaus are base-leveled surfaces now uplifted to a great altitude. The western plateau, the Maritime Andes, is still but little dissected; the eastern plateau, the Cordillera of the east, is thoroughly dissected, especially in its eastern portions. Both plateaus bear mountain ranges of conspicuous elevation above the general level of the surface, but the mountain ranges thus denoted are distinctly unlike either the plateau or each other as to origin. The lofty peaks and irregular ranges which constitute the truly mountainous portion of the Maritime Andes on the west, are of volcanic origin; the ranges which surmount the eastern plateau are residuals which survived the baseleveling process of an earlier geological period.

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[1] "Memorie Geografiche," Florence, 1907.

The volcanic peaks and ranges are represented by the Cerro de Vilcanote, the Cerro de Sillilica, etc.; while the Cordillera Real of La Paz, the Tunari of Cochabamba, and the Cerro de Potosi, are examples of residual heights. The two are alike in not occurring with sufficient frequency as generally to obscure those topographic and drainage features which denote peneplanation.

It must not be understood from the terminology thus employed that true mountainous conditions do not prevail. Within the Cordillera Real of the east, or the Sillilica range of the west, one has almost every variety of mountain scenery but there are great areas outside these ranges in which the plateau quality is the dominating one. In the western plateau large, undissected, plateau remnants with flat tops are discernible. In the eastern plateau, on the other hand, the dissection of the old surface has progressed to the point where only from the hilltops can the former appearance of the country be ascertained. The streams are now far below the old base level of erosion and have dissected the once flat surface to such an extent that from the valley bottoms one views the plateau remnants as mountain peaks and ranges. It is only the physiographer who looks upon the country as a plateau; the inhabitant understands the elevations as mountains, and the notches between headwater streams as mountain passes. The former view is necessary to understand the topography and drainage; the latter to understand the facts of human distribution and control.

Between the two great plateaus whose upper surfaces, with superposed ranges and individual peaks, constitute the eastern and western Andes, is an intermediate tract of similar origin. Once a part of the general peneplain formed here, it has been uplifted to a lesser height than the plateaus to east and west; or, if once at their level, has since been depressed. It is therefore an enclosed basin which, owing to the semi-arid climate prevailing here, has no outlet to the sea. Its interior drainage quality is indicated by the great salars of Coipasa and Uyuni—flat, wide, salt-incrusted basin floors which mark the ultimate discharge from Lake Poopó, a salt lake which in turn receives the excess of Lake Titicaca by way of the Desaguadero (The Drain) River.

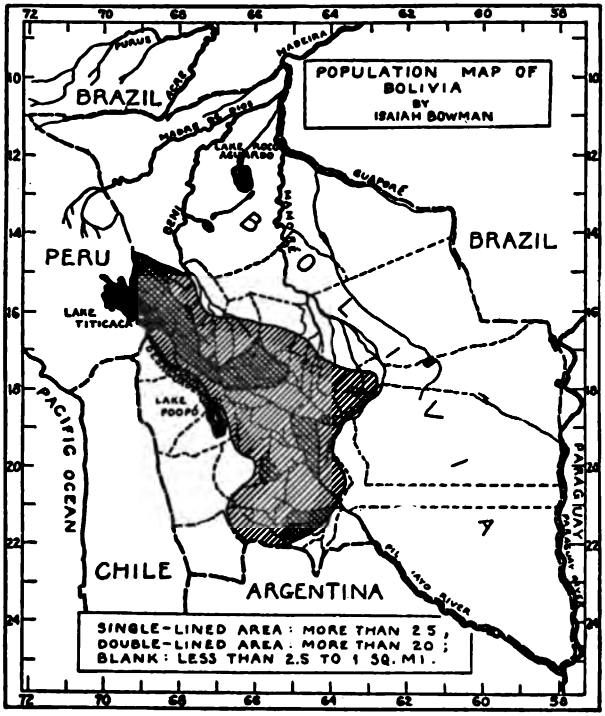

FIG. 1. Drawn from data in "Geografia de la República de Bolivia," official edition, 1905. A comparison of the population and zones of altitude maps is desirable in interpreting the distribution of people. Altitude alone, however, but partially explains the distribution in this case.

This interior basin, with tributary valleys and basins of higher elevation joining it at smooth grade, constitutes the "alti-plano" or "planicie" (high plain or plateau) of Bolivia. Its eastern and western limits are very definitely expressed by two roughly parallel and, for much of their distance, notably rectilinear fault scarps, which mark the change from higher to lower plateau or from the eastern and western Andes to the floor of the great interior basin. In whatever direction one travels from this central basin one is required first to ascend these scarps and the volcanic piles or the residuals previously noted, to reach the peripheral mountain or plateau areas of lesser elevation. Although the floor of the interior basin is remarkably flat over great areas, there are, in the aggregate, numerous interruptions of its surface both from volcanic accumulations irregularly disposed and from structural irregularities which bring important projections of the adjacent plateaus within the general outlines of the basin. Yet here, as in the adjacent plateaus, the dominant fact is not the irregularity of the topography, but its regularity, in spite of the numerous exceptions to the general rule. Finally, it may be noted that part of the regularity of the central basin is due to aggradation by tributary streams whereby a smooth floor of waste has concealed some of the minor irregularities once existing.

While many physiographic forms of the Central Andes are not included in this brief outline of the physical features, yet the most salient facts are here set forth and such omitted features as affect the distribution of the population will be examined later in relation to the particular human response they evoke.

It is a matter of common knowledge that the white populations of tropical South America seek the uplands to a notable degree. The explanation invariably offered is that the cooler climate of the uplands supplies an inducement which the unfavorable effects of high altitude upon heart, lungs, and general condition are unable to counterbalance. However, a closer inspection of the problem reveals a great many causes other than climatic which operate to hold important groups of the denser population and especially the white population of Bolivia (and the same would doubtless be true of Peru) in the highland section of that country to-day. In the first place, were climate the sole determinant in the distribution of the people of Bolivia, one would expect them to live (most of the country being well known) where the climate is most attractive. This ought to be true up to the point at which competition, through approach to completeness of occupation, gradually caused the population to spread to the less desirable peripheral areas. It is a noteworthy fact, then, that of the nine[2] most densely peopled provinces of Bolivia five are at elevations more than eleven thousand feet above the sea. At this elevation the climate is vernal during the summer season; but during the height of the winter season (May, June, and July) it is distinctly cold. Exact climatological data for the regions in point are not available. The statistics for La Paz (with an exceptionally favorable location) will indicate approximately the qualities of the climate at these high elevations. The mean annual tempera-

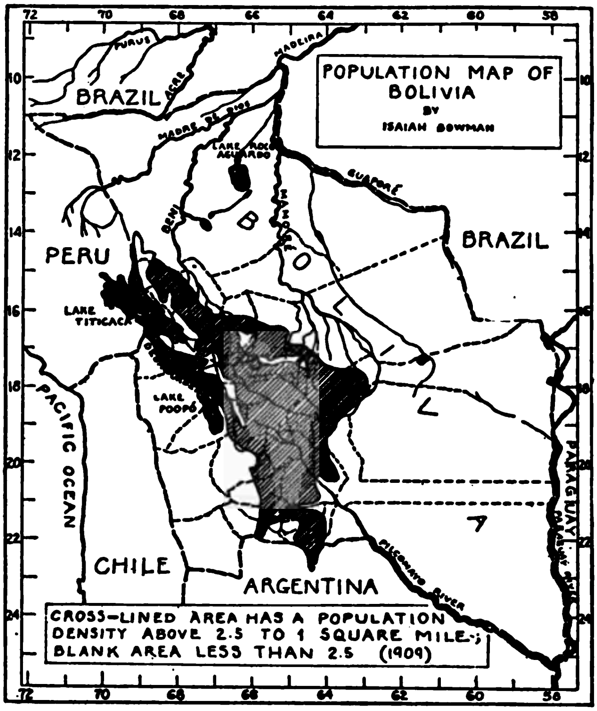

FIG. 2. A MORE ACCURATE REPRESENTATION OF THE POPULATION. Even a greater reduction of the inhabited area would follow upon the use of smaller areal units of distribution were these obtainable.

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[2] Department of La Paz, Provinces: Cercado, Muñecos. Department of Potosi, Province: Frias. Department of Oruro, Provinces: Cercado, Sicasica. Data from "Geografia de la República de Bolivia," official edition, La Paz, 1905, pp. 237–239.

ture of La Paz[3] is 50.4° F. The coldest months are June and July with a mean temperature of 45.3°; the warmest months are November and March, 53.9° and 54.7° respectively. The absolute extremes were 75.2°, in January, 1903; and 26.6°, in June, 1901. The prevailingly cold nights throughout the year show far less differences during summer and winter months than the daytime temperatures for the same seasons and hence diminish the effect of the daytime differences in a table of mean temperatures. The extreme temperatures are therefore as good an expression as the means of the seasonal temperature differences experienced by the inhabitants during the working hours of the day. One must find the real contrast between summer and winter daytime temperature in an intermediate point between mean and higher extreme and not between extremes.

The comparative absence of fuel at these high altitudes, the really cold weather during a six-weeks period in June and July, and the attenuated atmosphere, combine to render the high plateau section of Bolivia only superior to the hot eastern plains and coast valleys to a moderate degree. And, as for the intermediate levels, the basins and valleys of the eastern slope of the country, they are incomparably better in respect of climate, fuel, general healthfulness, and fertility, than are the plateaus. The most densely populated province of Bolivia is Cercado, in the Department of Cochabamba (8,400 feet), with a population of 108 to the square mile (41.71 per square kilometer). Furthermore, two other basin provinces, Punata and Tarata, in the Department of Cochabamba, exceed the population density of the provinces in which are located Oruro and La Paz. While, therefore, the provinces of greatest population density are in the basins and at a lower altitude and with generally more favorable climatic conditions, a slight majority of provinces of the first rank occur at an altitude where the climatic conditions are distinctly less hospitable. The conclusion of the matter is that, in point of fact, geographic position, the distribution of natural resources, the accessibility of routes of trade, and ease of communication are, with climate, factors of first importance, and a given distribution depends upon the resultant of these oftentimes divergent forces.

To characterize the controlling forces as divergent among themselves, one must be aware of the unfavorable physical layout of Bolivia. It is conceivable that similar forces might elsewhere be convergent and favorable. The chief commercial difficulties of a new country generally grow out of a lack of adequate means of transportation. The *healthy* route to the but moderately high basins of eastern Bolivia with their ideal climate is over the high western plateau and mountains to the Pacific seaboard. The carriers of Bolivia's commerce have always avoided the tropical Atlantic seaboard. The unnavigable stretches of rivers and the formidable list of tropical diseases have conspired to turn commerce in a direction opposite to the natural slope of the country. Hence certain strategic towns on the plateau have been notably increased by virtue of their position between dense basin populations and their outlet on the west

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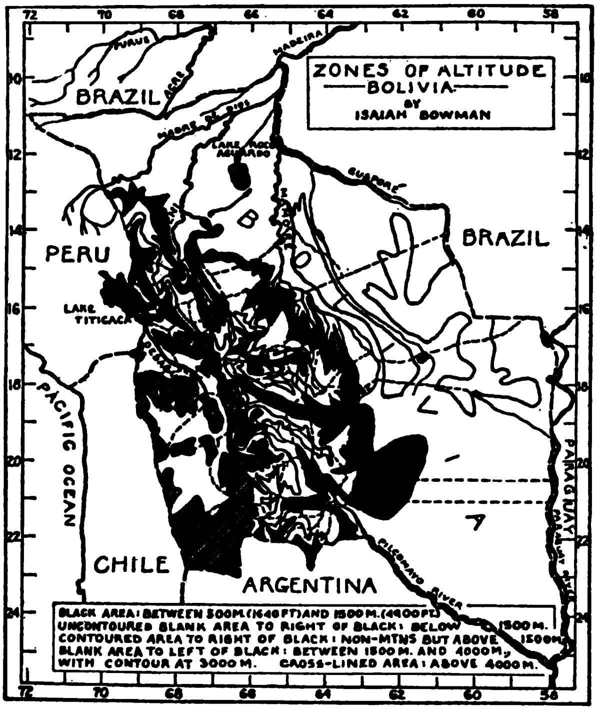
[3] V. E. Marchant, "Estudio sobre la Climatologie de La Paz," La Paz, 1904.


ZONES OF ALTITUDE
BOLIVIA
BY
ISAIAH BOWMAN
BRAZIL
BRAZIL
PERU
LAKE TITICACA
PACIFIC OCEAN
CHILE
ARGENTINA
PARAGUAY
PILCOMAYO RIVER
BLACK AREA: BETWEEN 500M.(1640FT.)AND 1500M.(4900FT.)
UNCONTOURED BLANK AREA TO RIGHT OF BLACK: BELOW 1500M.
CONTOURED AREA TO RIGHT OF BLACK: NON-MTNS BUT ABOVE 1500M.
BLANK AREA TO LEFT OF BLACK: BETWEEN 1500M. AND 4000M., WITH CONTOUR AT 3000M.
CROSS-LINED AREA: ABOVE 4000M.
72
70
68
66
64
62
60
58
10
12
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18
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22
24

FIG. 3. Except for the salars south and west of Lake Poopó the white area west of the black is in general the area of densest population, being especially well adapted for agriculture below the 3,000-meter contour.

coast. La Paz and Oruro are conspicuous examples of such benefit, independent of the more important controls by mining development and political activity.

To appreciate locations and boundaries employed in the detailed discussion, a reference to the accompanying maps is desirable. The first population map (Fig. 1) represents a rather empirical expression of the figures for population densities by provinces as given in the census returns. Certain of the more obviously unpeopled areas have been excluded but in the main but little change from the demand of these figures was made. The values of the boundaries of the two cross-lined areas, of 2.5 and 20 inhabitants per square mile, are selected because they represent natural distinctions of density. With few exceptions, the provinces of the blank areas have a population well below that of the cross-lined areas; the same may be said of a comparison of the two cross-lined areas. In short, the figures expressing densities by provinces do not form a regularly increasing series. There are great gaps between the light population of (1) the plains, high mountains, and salars, (2) the medium populations of the less lofty parts of mountains and plateaus, and (3) the dense population of great mining centers, rich valleys and valley basins, and the foci of trade. The second population map (Fig. 2) indicates a restriction of the boundaries within more reasonable limits. The Cordillara Real, the Tunari of Cochabamba, and certain highland tracts south of Potosi are excluded and the boundaries restricted elsewhere by known conditions of relief or climate, etc.[4]

The maps bring out certain important features rather strikingly. The population of Bolivia is concentrated in a highland zone and the contrasts between densest areas and least dense areas is extreme. Bolivia has, on the average, a population of only 3.1 per square mile. On an area more than twice that of the state of Texas, or twelve times that of Pennsylvania, or one sixth that of the whole United

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[4] In this way a map is obtained which is much closer to the truth than the first; that is, is such a map as one might obtain from a plotting of population densities on the bases of smaller areal units. As it stands, it is only an approximation, yet it is a decided improvement over the first map. The areas of densest population (20 + to the square mile) are not expressed at all on this map for the reason that an improvement of the boundaries of the first map in this respect is scarcely possible save by obtaining much more refined statistics or by personal examination of the field in detail.

States, Bolivia has a population (1,744,000) only about two thirds that of Texas, or one third that of Pennsylvania. The population of Iowa distinctly exceeds that of Bolivia though the areas are in the ratio of 1:26. Yet the maximum densities of rural populations in the irrigated tracts near Cochabamba, are paralleled in the United States only by exceedingly small areas near Pittsburg and Cincinnati, in eastern Pennsylvania, central New Jersey, etc.

To secure reasonably accurate quantitative as well as qualitative data, the areas of denser populations were carefully measured by weighing corresponding areas of uniform quality paper upon delicate balances. The results are tabulated below:

80 per cent. (79.77) of the population lives within the density area of 2.5 per square mile;

35 per cent. (34.44) lives within the area of 20 to the square mile.

—*or*—

80 per cent. of the people live upon 18 per cent. of the total area of the country;

35 per cent. live upon 5.21 per cent. of the area.

Upon the second population map (more accurate) 80 per cent. of the people live upon 15 per cent (14.58) of the total area.

However lofty are the situations occupied by rich mining centers to-day or by small groups of native Indian populations, the mountain population of Bolivia has been set certain boundaries which cannot be extended. So lofty is Bolivia that the aggregate area of the totally uninhabitable area of bleak, or snow and ice-covered, mountains is exceptionally large for a tropical land; perhaps 7 per cent of the total area. The salars of the great central basin are equally bleak and uninhabitable. The plains populations, while having greater potentialities, are likewise excessively thin. Bolivia is a land of topographic and climatic extremes. Rather narrowly limited is the really good land of the Republic. The extremes are so closely set that in spite of vast effort to exceed the reasonable limits of climate and rarefied air, the narrow band of population attests the stern control exercised over distribution by the physical layout of one of the most interesting political units of South America.

The confinement of the population to the small areas indicated upon the population maps may be better understood by noting the percentages of total area occupied by the various zones of altitude expressed upon Fig. 3. In selecting the limiting contours of the different zones of altitude attention was given to the distribution of the population and the determining features of the relief. The valley basins of Cochabamba and Sucre, the great alti-plano of western Bolivia, and the more densely populated parts of the eastern valleys are included in the western blank area. The 3,000-meter contour in turn subdivides the alti-plano from the eastern basins and valleys. The population above 13,000 feet is exceedingly limited and is attracted to that altitude only by the mines or by the high pastures of the migratory flocks of llamas and sheep. For convenience the percentage of area of the different zones are tabulated as follows:

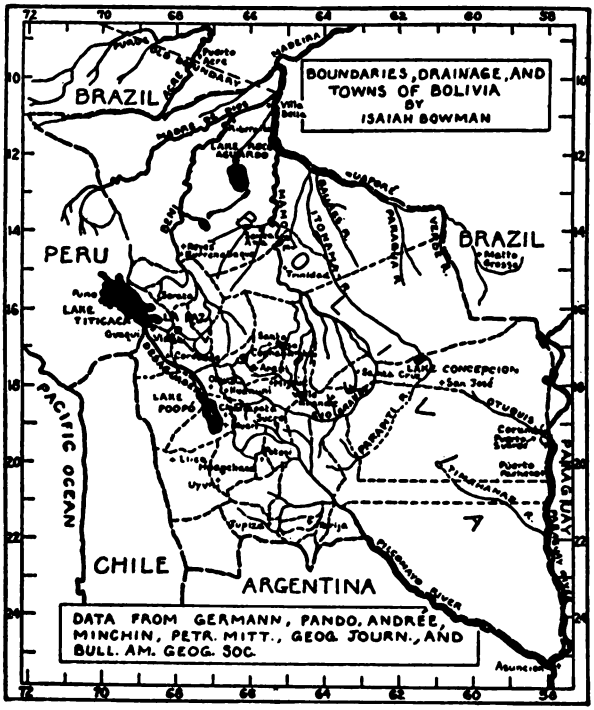
BOUNDARIES, DRAINAGE, AND TOWNS OF BOLIVIA BY ISAIAH BOWMAN
BRAZIL
PERU
BRAZIL
Matto Grosso
LAKE TITICACA
LAKE POOPO
Concepcion
San José
PACIFIC OCEAN
CHILE
ARGENTINA
PARAGUAY
Asuncion
DATA FROM GERMANN, PANDO, ANDREE, MINCHIN, PETR. MITT., GEOG. JOURN., AND BULL. AM. GEOG. SOC.
72
70
68
66
64
62
60
58
10
12
14
16
18
20
22
24

FIG. 4. Only the most important locations are here shown. The map serves as a guide in locating the place names employed in the text.

I. The black area, the hot lower valleys and mountain slopes between 500 and 1,500 meters = 12 per cent. (11.73) of total area.

II. The white area west of black (in parts of which practically all the people of Bolivia live. Parts of the white area are salars known to be uninhabited) between 1,500 and 4,000 meters = 15 per cent. (15.36) of the total area.

III. The cross-lined area, above 4,000 meters (13,000 + feet) in part approaches and in part exceeds the limit of habitation. It includes all the uninhabited mountain area = 11 per cent. (11.07).

IV. The white area east of black area (exclusive of the low sandstone plateau just exceeding the 500-meter contour between the Rio Verde and Santa Cruz) = 62 per cent. (61.84) of the total area.

Summarizing, roughly, one third of Bolivia is upland and two-thirds plains. The population lives chiefly upon one half of the upland area or one sixth of the total area. It is undeniable that about one half of this occupied upland area or one twelfth of the whole is unfavorably situated for altitude, health, and comfort. It attracts people because of mineral riches or geographic position with respect to routes of trade, themselves strictly controlled by geographic circumstances. The happiest and densest population groups of Bolivia are found at about 8,000 feet, where favorable physical conditions to a certain degree counteract the effects of geographic isolation. The isolation is emphasized by the physical conditions of eastern Bolivia. The remarkable steepness of descent of the eastern mountain slopes is only equalled by the flatness of the adjacent plains. Santa Rosa, at the head of navigation on the Chaparé, 30 miles from the eastern scarp of the Andes, is only 700–800 feet above sea level though 3,500 miles from the sea. The Amazon basin is undoubtedly the flattest extensive river basin in the world. Great stretches of its course are really only huge elongated lakes joined to each other by gently inclined reaches. The reduction of the transitional zone of moderately elevated land at the border of the mountain tract to a narrow band not only reduces the area of most favorable land but establishes a difficulty in the use of the area actually in existence by separating the fertile and densely populated zone from the zone of navigable streams by a belt of unnavigable mountain torrents, several score miles in width.

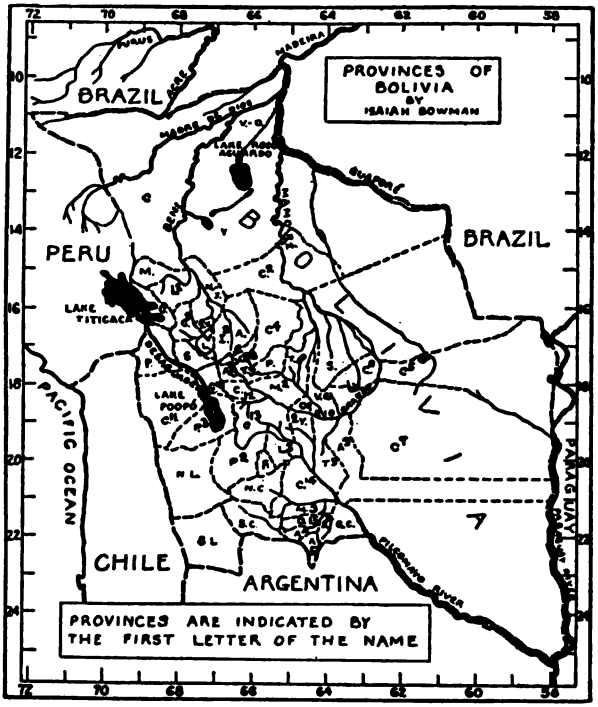

Fig. 5. Names of provinces below are arranged roughly in order from north to south. Duplicate initial letters are distinguished by index figures.

C = Caupolican.
V-D = Vaca-Diaz.
Y = Yacuma.
I = Itenez.
C^{2} = Cercado (Beni).
N-J = Nor-Yungas
L = Loaiza.
M = Muñecas.
O = Omasuyo
C^{3} = Cercado (LaPaz).
S. Y. = Sud-Yungas.
L^{2} = Larecaja.
I^{2} = Inquisivi.
A = Ayopaya.
C^{4} = Chaparé.
V = Velasco.
C^{5} = Chiquitos.
C^{6} = Cercado (Santa Cruz).
S = Sara.
V-G = Valle-Grande.
C^{7} = Cordillera.
T = Totora.
T^{2} = Tapacari.
P = Punata.
C^{8} = Cercado (Cochabamba).
A^{2} = Arque.
T^{3} = Tarata.
M^{2} = Misque.
C^{9} = Campero.
P = Pacajes.
S = Sicasica.
C^{10} = Cercado (Oruro).*
P^{2} = Paria.
C^{11} = Carangas.
P = Poopó.
C^{12} = Charcos.
C^{13} = Chayanta.
P^{3} = Porco.
F = Frias.
L^{3} = Linares.
Y^{2} = Yamparaez.
T^{3} = Tomina.
C^{14} = Cinti.
A^{3} = Acero.
N.-L. = Nor-Lipez.
S.-L. = Sud-Lipez.
N.-C. = Nor-Chichas.
S.-C. = Sud-Chichas.
M^{3} = Mendez.
C^{15} = Cercado (Tarija).
A^{4} = Avilez.
A^{5} = Arce.
S^{2} = Salinas
G.-C. = Gran Chaco.

* Names of Provinces inadvertently omitted from official census. Names of provinces for this department obtained from best maps.

The concentration of cities upon the plateau (Fig. 4), the small size of the provinces there (Fig. 5) as compared with the huge provinces of the plains, Chiquitos, Santa Cruz, and Caupolican, are a clear indication of the dense populations of the former and the more precious quality of the land. Even in the region of smaller provinces, there is a clear indication that notable quantities of land are unused or unimportant. The boundaries of the provinces for the most part follow either the divides or the stream courses, or both. The divide boundaries are decidedly indefinite, the country lacking practical worth. Accurate surveys will not be made for many years to come in districts not rich in valuable minerals.

The chief control of population distribution upon the plateau and high mountain valleys is the mineral wealth of these sections. The silver, copper and tin mines of Oruro, the tin mines of Huynuni, the silver of Potosi, are the forces which hold the population groups of these localities to contact with such otherwise unfavorable environments. The province of Frias (the name itself is significant), in the Department of Potosi, has a population density of 39.5 per square mile and is seventh in point of density in a list of the 52 provinces of the Republic. In a list of the 151 most important towns, Potosi is, however, 141st as to elevation (13,680 feet), being exceeded by no town of any importance. La Paz, and the line of settlements between it and Lake Titicaca, whatever the causes that formerly controlled their distribution, must be ascribed to-day to the stream of trade which not only the railways but the caravans support. This was from the very beginning of Spanish development one of the greatest highways of trade in South America. La Paz is the focus of two great tropical and semitropical sections of Bolivia. The Beni and the Rio Grande (Fig. 3) reach great long valley fingers almost up to the borders of the province of Cercado in which La Paz is located. Lake Titicaca directs the stream of trade westward 140 miles whence but another 330 miles takes one to the Pacific seaboard. Caupolican, Bolivia, and the plains and valleys of Mojos and Yungas are the feeders of commercial La Paz to as important a degree as the mines.

The vertical distribution of the cities and towns of Bolivia is in striking contrast to that of the population centers of other mountain areas. Using as the basis of computation the statistical tables given in "Geografica de la República de Bolivia,"[5] we have computed the following:

Total number of important cities and towns in Bolivia = 151	100 per cent.
Cities and towns above 11,000 feet, 77	51 per cent.
Cities and towns above 12,000 feet, 73	47 per cent.
Cities and towns above 13,000 feet, 26	17 per cent.
Cities and towns above 14,000 feet, 4	3 per cent
Maximum elevation, Aullagas	15,700 feet.
Minimum elevation, Puerto Pacheco	330 feet.
Average elevation of the 151 important cities and towns of Bolivia	8,900 feet.

The wide distribution of the native population of Bolivia is as important a fact as the concentration of the white population in very limited areas. There are a few scattered tribes, Tobas, etc., along the Pilcomayo, their savage character excluding all attempts at development. Hostile savages range the forests of the Alto Acre west of the confluence of the Yaverija near which rubber exploitation (hence white population) ends.[6] The white populations of the plains cling to the river banks. The lack of means of communication precludes any attempt to develop the interstream areas. As Col. Church has put it,[7] "He is a bold man who will match his one pair of arms against the forces of Nature in a malarial, tropical forest." The feeble hold upon the land possessed by the white population of the plains would be more strikingly shown upon a population map were the distribution and density actually represented along the river courses. The blank interfluve areas would then indicate entire absence of white population and, to a very large degree, native population as well. Only the completeness of the network of streams upon the tropical plains has rendered Bolivia's rubber and chocolate and hides measurably available. It will be long before the *lines* of riparian peoples have become *bands* and it is doubtful if wide diffusion will ever occur because of the extraordinary difficulties of disease, drainage, and communication, as compared with the more highly favored lands of the earth. The isolation of the separate plains valleys is interestingly reflected in the extraordinary multitude of languages found among the plains Indians. D'Orbigny claims 27 different dialects in a population of less than 50,000 in Mojos and Chiquitos. On the same scale London ought to have 2,700 languages.[8]

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[5] Edicion oficial, La Paz, 1905, pp. 82-85.

[6] Major P. H. Fawcett, "Survey Work on the Frontier between Bolivia and Brazil," *Geog. Journ.*, Vol. 33, No. 2, February, 1909, p. 181.

[7] "Costa Rica," *Geog. Journ.* (London), Vol. 10, 1897, p. 76.

The plains populations have been much reduced by the incessant demands of the rubber collectors and the brutal system of peonage this has originated. Slave raids have embittered many a tribe and turned them into the more impenetrable portions of plains Bolivia. Never a densely populated part, it is being still further depleted in spite of the accessions of white men. It bids fair long to remain the great wilderness it is to-day, threaded only by thin lines of river settlements and small, widely scattered towns.

It is noteworthy that scarcely any concentrated populations occur upon the plains anywhere. The nearest approach is in the vicinity of Villa Bella where converge the great river systems of northeastern Bolivia, the Beni, Madre de Dios, Mamoré, and Guaporé. What with this great junta of waters and the obstruction of the line of rapids above San Antonio, and the necessity for rehandling thus imposed, a few towns of importance have arisen. Trinidad is a great distributing port for the grass lands and river ways in its vicinity, a depot of supplies. Likewise, Santa Cruz supplies the adjacent region, ships tropical products to the plateau, and is an outlet for the rubber, chocolate, and hides of the middle Rio Grande and its affluents to Puerto Suarez and Corumbá on the Paraguay. The remarkable convergence of these great through river ways toward a point at Villa Bella has emphasized the lack of white population in the neighboring areas. The Itonama, Paragua, and Verde, on the one hand, and the Alto Acre, Aquiry, and Abuna, on the other, are without settlers, either temporary or permanent. They are to one side of the trade currents of their rivals, the Beni, Mamoré, Chaparé, and Madre de Dios. The latter are accessible and may be and are being developed both from the Bolivian highland and from the direction of the Amazon. Considering the length of time which the great convergent rivers have been developing, and the number of whites who traverse them yearly, it is astonishing to find how unknown are some of the adjacent rivers that are inhabited by hostile savages, or head upon the plains in situations inaccessible from the mountains, or are so shallow as to exclude the launches and batelons of the rubber gatherers, or are incapable of development through lack of native population and therefore of labor. The heroic achievements of Major Fawcett[9] in traversing the new boundaries between Bolivia and Brazil, as determined by the treaty of Acre in 1903, have reemphasized the loneliness of some of the great plains tracts lying outside of the central zone of development. The Rio Verde, on the Matto Grosso frontier of Brazil, has until now been a mystery and is to-day totally uninhabited and even unvisited by those pioneers of development, the rubber men. On the southeastern limits of Bolivia is the Gran Chaco, inhabited by the fierce Tobas and other wild tribes of the Pilcomayo and by a dozen other tribes along the Paraguay, Parapiti and other streams, but without important numbers of whites. A few are found in small settlements along the Paraguay but they are strictly riparian. The dry scrub plains of the interior are riverless or without through river ways on account of the prevailingly dry climate. The only part developed by white men is the belt of territory along the cart and mule track between Santa Cruz de la Sierra and Puerto Suarez. On the north an area as large as the state of South Carolina and on the south an area as large as New York state are great tropical and subtropical wastes.

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[8] E. Baron Nordenskiold, "Travels on the Boundaries of Bolivia and Peru," *Geog. Journ.*, Vol. 28, 1906, p. 129.

It is one of the most noteworthy facts of Bolivian geography that even the most extraordinarily lofty and inaccessible places have or have recently had inhabitants. It is a rare bit of travel that leads to localities in which some traces of former or present occupation may not be found. Neither are the abodes confined to the temporary corrals of the llama drivers or the limits of summer grazing. They have been found well up toward the snow-line at elevations of 16,000 feet, and more, in the most incredibly bleak situations.

The analysis of the historical and anthropological evidence by Ballivian[10] and others, seems to fix the cause of the extreme diffusion of the mountain Indians. Before the Spanish conquest the mountain people on the one hand and the plateau and mountain and valley peoples on the other appear to have been in constant strife. In Indian legend this is designated the epoch of darkness and insecurity, during which the *chullpas* lived in the now generally abandoned and lofty abodes called by that name.[11] In the seventh decade of the sixteenth century, Francisco de Toledo found the *puna* covered with chullpas inhabitants, scattered about without order either in complete isolation or in small groups only and in a state of incessant hostility among themselves and between themselves and the mountain peoples. His concentration *ordenanzos* collected the people into pueblos with a church and village organization. The effect of the enforcement of this beneficent order was the decay of the chullpa life, the ruin of the chullpa abodes, and the complete reorganization of the mode of life of the mountain and plateau peoples of Bolivia. Since then the abandoned and now ruined chullpas have served only as burial places for the dead. These are buried beneath the floors of the huts which was true even during the period of their occupation, in fact this seems to have been the sole place of interment. The number of bodies found in a single excavation has been very great. It may well have been that the occasional temporary abode of the plateau peoples in houses of refuge in the mountains (a well-established fact) may have offered considerable stimulation to the wide diffusion of the more truly mountain dwellers. The plateau groups had no means of defense save these houses of refuge. Their villages were without moats or walls. In time of defeat, safety lay in escape to the mountains, where, as in the cerro de Pucarani, at least provisional and fortified refuge was afforded. It was a common measure of safety to have such localities, capable of defense, prepared in an adjacent mountain knot.

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[9] *The Geog. Journ.*, Vol. 33, 1909, pp. 181–185.

[10] "Geografia de la República de Bolivia," Chapter II, p. 122 et seq.

The plateau population has in many places not yet wholly recovered from the effects of the strange fever of 1866. It raged among the Indians and in spite of their every effort to spread it among the whites its ravages were confined to the natives who were in many sections greatly reduced in number.[12]

A highly important feature of Bolivian topography is the occurrence of relatively flat-floored valley basins of notable extent at the heads of each one of the great fluvial systems. Sucre, toward the head of the Pilcomayo; Cochabamba, near the head of the Rio Grande, are the most conspicuous examples. Tarija, Tupiza, Punata and Arani are examples of locations in valley basins near the heads of tributaries. The two first-named basins are the largest and are of chief importance, containing the densest population groups of Bolivia. Their vernal climate, their irrigation possibilities, and their nearness to the plains and the plains products—sugar, rice, chocolate, etc.—conspire to favor them beyond any other portion of the country. Their chief defect is their inaccessibility. Eastward an outlet is assured only by traversing 500 miles of scrub between them and the Paraguay: westward two lofty plateaus with high passes and a narrow coast desert bar them from the Pacific seaboard. Considering comfort alone, the population of Bolivia should be in these basins and valleys of the eastern Andes. The plateau and mountain distribution are, for the whites, a compromise with hard conditions in view of the allurements of speedier wealth and the geographical location of the means to secure it.

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[11] Cf. Cieza de Leon, Salcamayhua, Pacaes, Vaca de Castro, and other authors and works of the sixteenth century.

[12] Musters' "Notes on Bolivia, to Accompany Original Maps," *Journ. Royal Geog. Soc.*, Vol. 44, pp. 201–216.

The difficulties of seaboard communication for the eastern valleys and valley basins may be suggested by a reference to the following physiographic facts. It was indicated in an earlier paragraph that a mountain peak map representing peaks over 12,000 feet high would have to be colored black over great areas; no less true would the statement be for 13,000 or 14,000 feet heights, so prevailingly and exceedingly lofty is much of mountainous Bolivia. The facts may perhaps be most strikingly presented by noting the heights of the principal peaks and passes. In a list of 59 highest peaks of Bolivia, published in the "Geografia de la República de Bolivia" the average altitude is computed by the writer to be 16,757 feet. The heights of the passes are still more significant because they are the practical heights of a mountain tract for trade and communication in general. In the Maritime Cordillera ten passes are indicated. These range in height from 12,540 feet (Ascotan) to 15,516 feet (Sillilica). The average altitude is 14,051 feet. The recorded passes of the Cordillera Real are six in number; the average height of all, 15,104 feet. The passes of the southern part of the republic are fourteen in number; the lowest, 12,015 feet; the highest, 16,005 feet; the average height of all, 14,886 feet.

The borderland region of Bolivia is, *par excellence,* the western edge of the forested area extending to, say 9,000 feet on the flanks of that part of the eastern Andes that is exposed to the southeast trades. The difficulty of penetrating or developing a tropical forest is such that the culture of the Incas stopped here and in a few days one may ride from the irrigated and relatively well-developed plateau section to the lower slopes and plains where primeval forests shelter unaffected Indians in the Stone Age[18] of development. The agriculturists of the plateau and the cattle keepers of the fells are alike deterred from entry into the forests. The one because of the luxuriant competitive vegetation; the other because of the insects, and tropical diseases.

Upon the extreme western border of Bolivia is a fringe of population perhaps more interesting than that in any other isolated portion of the Republic. West of the fringe of people bordering the edge of the eastern plateau from La Paz south past Oruro to Uyuni are the great salars of the Poopó basin, the salars de Coipasa and Uyuni. They are wholly unpeopled, being without pasture. Beyond them, on the eastern edge of the Maritime Andes, are the quaint old Indian towns that form the outposts of Bolivia toward Chile. They stretch in a thin line, or belt, all the way from Lake Titicaca south to the Argentine frontier. The life of these settlements is curiously remote from the great currents of trade and travel in Bolivia, and the shy mountain folk that dwell in them are undoubtedly among the most interesting of all the population groups of South America. Increase of population in this region is only to be expected through the development of the mineral wealth in the Maritime Andes. The pastures would bear but little further development and the water supply is also used practically to the limit of its capacity. Few new centers of population could be developed and among the old ones only the most limited extension could be made with the present sources of power.

The limit of population capacity in Bolivia is far from being reached to-day. Clever as the highland farmer is in utilizing the water supply of his semi-arid land his methods are still far from being as good as those of the trained engineer. One admires his work more as the product of his particular intelligence than as illustrating the best in an absolute sense. In Peru, governmental interest in irrigation, with its correlative problems of water storage and improved cultural methods, in being worthily expressed in annual appropriations for surveys and works, and in reports of the highest value prepared by competent engineers. Bolivia has not yet reached this point of interest. Irrigation works are still almost wholly local in spite of the opportunities that the high plateau, and the valley basins of Cochabamba, Cliza, Sucre, and Tupiza offer for water conservation on a large scale.

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[18] Nordenskiold, E. Baron, "Travels on the Boundaries of Bolivia and Peru," *Geog. Journ.* (London), Vol. 28, 1906, pp. 105–130.

GEOGRAPHICAL NEWS AND NOTES

In a recent report to Parliament, Professor Wyndham Dunstan, Director of the Imperial Institute, points out many important facts concerning the cultivation of cotton in Asia Minor, especially in the district of Anatolia and Cilicia. The soil and climate of large areas are particularly suitable for the crop, even without irrigation, while there is a fair abundance of cheap labor. American upland cotton is grown with good success, and with the aid of irrigation the long staple Egyptian cotton yields excellent results. The present extensions of the railway systems will give an important impetus to the industry, and it is not unlikely that the future will witness an extensive growing of American cotton in Asia Minor to supply the Lancashire mills. In any case this district must be considered seriously in any forecast of the future of the cotton industry.

In the *Journal of the Scottish Meteorological Society* (January, 1909) an article on the climate of the Orkney Islands suggests that the climate is changing, the summers becoming colder and the winters less severe. The virtual absence of arborescent vegetation at present is regarded as one important indication of this tendency, and especially so since the only remnants of tree growth are in the most sheltered places. Other types of vegetation, also formerly abundant, are now rare and gradually disappearing apparently because of inability to ripen their seeds.

The Scottish Geographical Magazine (January, 1909) contains an interesting article on the agricultural potentialities of the Transvaal, by the editor of the Transvaal, Department of Agriculture, Mr. William MacDonald. It must come as a surprise to many to learn that this region, known mainly for its large gold output, has far greater wealth in its soil resources. Maize, wheat, oats, cotton, tobacco and sugar cane are some of the crops to which important areas are said to be naturally adapted, while in the live stock industries enormous possibilities are suggested.

La Géographie publishes some facts concerning the sleeping sickness of Africa of especial interest at the present time because of the discussion of the Smithsonian expedition under the direction of President Roosevelt. The flies which carry the disease are intimately dependent on temperature conditions, temperatures exceeding 30° C. being fatal for the adults and 35° C. for the young of the species. Hence they are shade-loving insects, haunting dense woods, usually in the vicinity of water bodies where the wild animals congregate or come to drink. It is only when the larger wild animals are scarce that the flies invade the native haunts, such as fords and bathing places, and the sleeping sickness becomes widespread. This shade-loving character makes prevention quite possible, by a thorough clearing of all inhabited places near water bodies, thus destroying the chance to breed.

The close connection between imperfect agricultural development and large wool production is emphasized by a note in the *Revue Général des Sciences* (August) discussing the world's production of wool during the last ten years. It appears that the production is stationary or actually declining in European districts; in the United States and in South America other branches of agriculture are pushing out sheep raising on the natural range. In Australia, on the contrary, the increase is steady, and because of the natural adaptation of Australian localities to sheep raising, the conclusion is drawn that this region must be looked to as the great source of supply.

Dr. Ellsworth Huntington, of Yale University, left New York in February, for Asia Minor, where he intends to continue his explorations and gather additional evidence of the fluctuations of climate. His proposed plan is to visit the Dead Sea first in order to determine any changes of level which it has undergone; from there he expects to proceed to the Syrian desert and to the basin region of central Asia Minor. Much interest is felt in this expedition, representing as it does a somewhat new phase of exploration, in that the chief object is to observe the relation of the people to their environment and to gather evidence of physical changes which have occurred in historic times.

BOOK NOTES AND REVIEWS

Angier, A. G. *The Far East Revisited.* Pp. 364. Witherby & Co., London, 1908.

The familiarity of the author with conditions in the Far East gives the weight of authority to his comments on present tendencies and developments in that part of the world. To all who are interested in the affairs of the East, especially in the case of China, Japan and Korea, to which most of the volume is devoted, the book can be heartily recommended. In these countries, which are now decidedly awake and actively engaged in developments that are carrying them into a prominent place in world affairs, a clear appreciation of the transformations comes most readily through comparisons between past and present. It is in just this respect that the author has done a real service by the comparisons which he could make after his different visits. This element of comparison is, perhaps, the chief distinguishing characteristic of a volume which can not be too highly commended.

Baedeker, Karl. *Greece.* Pp. 447. Karl Baedeker, Leipzig, 1909.

European tourists will welcome this new revision and bringing up to date of the guidebook to Greece. The present edition has been enlarged in order to incorporate the results of recent important archæological investigations. The improvements in the means of communication in the country are also noted; both prominent features of the revision adding very materially to the usefulness of the volume in rendering personal guides largely unnecessary.

Bain, R. N. *Slavonic Europe.* Pp. 452. Cambridge University Press, 1908.

This volume is not as comprehensive as its title would indicate, since it deals only with the political history of Poland and Russia from the middle of the fifteenth to the end of the eighteenth century, when the Republic of Poland disappeared from the map of Europe, and the Russian Empire took its place as the head of the Slavonic world. It begins, therefore, with the reign of Casimir IV and ends with that of Catherine II. Even with such a limited scope, however, the author has had a large task in handling such a complicated subject and compressing his available material into the space of a single volume. That this has been done with rare appreciation of relative values is proved by the attractive manner in which the panorama of important events is set forth clearly. Three very good maps add greatly to the value of the volume from the reader's standpoint.

Ladd, G. T. *In Korea with Marquis Ito.* Pp. 477. Longmans, Green & Co., New York, 1908.

As indicated by the title the author enjoyed rather unusual opportunities and facilities for observing conditions in Korea. Yet the fact that he was being guided by Japanese does not seem to have led him seriously into the prejudice of partisanship. Close observation of the many things to be seen on his journeys have enabled the author to give a very good idea of the country, the people and their life.

Le Blond, Mrs. Aubrey. *Mountaineering in the Land of the Midnight Sun.* Pp. 304. J. B. Lippincott Co., Philadelphia, 1908.

Everyone who feels the spirit of nature and responds to the call to travel will be strongly tempted by Mrs. Le Blond's book to begin his wanderings anew and seek the beautiful scenes portrayed in this attractive volume. The book deals not only with the mountain heights to be scaled, but also incidentally with many other aspects of Norwegian localities, and is written in a very delightful manner. The most striking feature of the volume, however, is the great profusion of unusually good illustrations. No less than seventy illustrations, many of them of strikingly beautiful mountain scenery, give an idea of the attractions of Norway which no amount of description could convey. The alpine enthusiast especially will find the book decidedly interesting.

Reynolds, J. B. *Regional Geography: Asia.* Pp. 128. A. and C. Black, London, 1908.

This new volume in the author's series of regional geographies can not be regarded as likely to increase her reputation as a geographer. No statement is made concerning the class of students for whom it is intended, and from the text it is impossible to arrive at any definite conclusion. At times the subject matter is presented in the most elementary form, apparently for a student who has had no previous acquaintance with geography. At other times the text is entirely too advanced for any young student, and, in fact, too fragmentary for the older student. The book really presents nothing new either in text or in treatment; its most serious faults are the attempt to enumerate too many facts in too small compass, and the unnecessary use of too many words printed in unusually bold-face type. The chief redeeming feature is found in the maps and diagrams, though some of them are not all that could be desired.

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Geology of the Seward Peninsula Tin Deposits, Alaska. By Adolph Knopf. (U. S. Geol. Surv. Bull. No. 358.) Washington: 1908.

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Twenty-ninth Annual Report of the Director of the United States Geological Survey to the Secretary of the Interior, for the fiscal year ending June 30, 1908.

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Comparative Tests of Run-of-mine and Briquetted Coal on Locomotives. By W. F. M. Goss. (U. S. Geol. Surv. Bull. No. 363.) Washington: 1908.

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MAPS

Pilot Charts of the North Atlantic Ocean for January, February and March, 1909.

Pilot Charts of the North Pacific Ocean for January, February and March, 1909.

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Griffith, Mr. Robert M.,
233 Chestnut St.

Griscom, Mrs. Rodman E.,
Haverford, Pa.

Grubb, Miss Martha S.,
4222 Walnut St.

Guilbert, Mr. C. H.,
903 South 47th St.

Hacker, Mrs. Charles,
1820 South Rittenhouse Sq.

Haeseler, Mrs. Albert S.,
3735 Walnut St.

Haines, Mr. Robt. Bowne, Jr.,
156 West School House Lane,
Germantown.

Haines, Mr. William A.,
137 North 7th St.

Hale, Mr. H. Warren K.,
1510 North Broad St.

Hall, Mrs. William H.,
Ridley Park, Pa.

Hallowell, Mr. F. Wallace,
113 South Broad St.

Hallowell, Mr. William S.,
3305 Race St.

Hallowell, Mrs. Wm. S.,
3305 Race St.

Hammond, Dr. Levi J.,
1222 Spruce St.

Hansche, Miss Maude Bingham,
4811 Springfield Ave.

Harlan, Miss Georgia,
510 Walnut St.

Harned, Miss Katherine S.,
Llanerch, Pa.

Harned, Mrs. Wilfred H.,
124 Paine St.,
Worcester, Mass.

Harper, Miss Lidie B.,
2035 Wallace St.

Harper, Mr. Thomas B.,
Union League Club.

*Harper, Mrs. T. Roberts,
1921 North 12th St.

Harris, Mr. Franklin M., Jr.,
1913 North 33d St.

Harrison, Mr. Geo. L., Jr.,
400 Chestnut St.

Harrop, Mr. Charles T.,
1731 Oxford St.

Harshberger, John. W., Ph.D.,
4839 Walton Ave.,

Hart, Mr. Gavin W.,
1316 Spring Garden St.

Hart, Mrs. Gavin W.,
1316 Spring Garden St.

Harte, Dr. Richard H.,
1503 Spruce St.

Harvey, Miss Annie,
236 West Horter St.,
Germantown.

Hastings, Mr. George T.,
4228 Regent St.

Haupt, Mrs. Henry E.,
2026 Race St.

Haupt, Mr. William K.,
Colonial Trust Company.

Hawley, Col. J. W.,
The Aldine.

Hays, Dr. I. Minis,
266 South 21st St.

Hays, Mr. Joseph,
Care Lanston Monotype Mch. Co., 1231 Callowhill St.

Heaton, Mrs. George W.,
309 South 41st St.

Heberton, Mrs. George V. G.,
414 Church Lane,
Germantown.

Heckel, Mrs. George B.,
4032 Chestnut St.

Hensel, Miss Charlotte C.,
1333 North Broad St.

Hensel, Mrs. Ella Caven,
Haverford, Pa.

Henson, Mr. Edward F.,
226 School Lane,
Germantown.

Henszey, Mr. Wm. P.,
500 North Broad St.

Herr, Mrs. Augusta,
1914 North 22d St.

Hessenbruch, Mrs. H.,
Wynnewood, Pa.

Hewitt, Mr. Charles,
428 West Stafford St.,
Germantown.

Hibbs, Miss Laura,
28 East Mt. Pleasant Ave.,
Mt. Airy.

Higbee, Mrs. William,
1703 South Broad St.

Hill, Mrs. Elizabeth A.,
1519 North 15th St.

Hill, Mr. George H.,
S. E. Cor. 5th and Chestnut Sts.

Hill, Mr. James Miller,
2020 North 15th St.

Hill, Mr. Thos. R.,
4629 Baltimore Ave.

Himmelwright, Dr. Francis E.,
2002 North 8th St.

Hochstrasser, Miss Emily A.,
200 South 39th St.

Hodge, Miss Isabella,
2045 Wallace St.

*Hoffman, Mr. Benj. R.,
60th St. and Baltimore Ave.

Holland, Miss Lilly E.,
1541 Diamond St.

Holm, Mr. James M.,
4043 Aspen St.

Holmes, Mr. Joshua M.,
Oak Lane Ave. below 11th St.,
Oak Lane.

Holmes, Miss Mary S.,
147 West Manheim St.,
Germantown.

Holton, Mr. John S. W.,
741 North 40th St.

*Hopkins, Miss Maude G.,
3405 Powelton Ave.

Hopper, Mr. Harry S.,
Narberth P. O., Pa.

Horn, Miss Katherine S.,
The Belgravia,
18th and Chestnut Sts.

Horton, Mr. A. W.,
5331 Wayne Ave.,
Germantown.

*Houston, Mr. Samuel F.,
Willow Grove Ave. and Cherokee St., Chestnut Hill.

Howard, Mr. Daniel W.,
1608 Master St.

*Howell, Mr. Edward I. H.,
5218 Germantown Ave.,
Germantown.

Howell, Mr. Francis C.,
Care Camden National Bank,
Camden, N. J.

Howell, Mrs. Samuel,
925 North 20th St.

Huneker, Mr. John F.,
N. E. Cor. 16th and Sansom Sts.

Hunter, Mr. William H.,
1756 Taney St.

Hurlick, Miss Susan G.,
4216 Pine St.

Hutt, Mr. W. H., Jr.,
400 Chestnut St.

Hyde, Mrs. Henrietta N.,
5925 Woodbine Ave.

Inskeep, Mr. Henry W.,
4930 Rubicam Ave.,
Germantown.

d'Invilliers, Mr. Chas. E.,
3317 Walnut St.

Irving, Mr. Wm. A.,
Chester, Pa.

Irving, Mrs. Wm. A.,
Chester, Pa.,

Irwin, Mrs. James,
2010 Park Ave.

Jackson, Mrs. J. T.,
113 South 19th St.

Jacob, Mr. Robert Urie,
1521 West Norris St.

James, Mr. Alvan T.,
4716 Windsor St.

James, Mr. Edwin,
219 Price Ave.,
Narberth, Pa.

*Janney, Mr. Nathaniel E.,
1002 Pennsylvania Bldg.

Jarden, Mrs. Samuel B.,
4607 Cedar Ave.

Jarvis, Miss Anna,
2031 North 12th St.

Jayne, Dr. Harry W.,
Elkins Park, Pa.

Jeanes, Mr. Isaac W.,
Aldine Hotel,
Chestnut above 19th St.

*Jellett, Mr. Edwin C.,
118 Herman St.,
Germantown.

*Jenkins, Mr. Charles F.,
150 West Washington Lane,
Germantown.

Jenks, Mrs. Wm. Furness,
920 Clinton St.

Joekel, Mr. Frederie Blair,
4014 Pine St.

Johnson, Mr. Alba B.,
Rosemont, Pa.

Johnson, Professor Emory R.,
Hamilton Court.

Johnson, Mrs. Emory R.,
Hamilton Court.

Johnson, Mr. F. M.,
323 South 43d St.

Johnson, Miss Mary S.,
120 South 43d St.

Johnson, Mr. Topliff,
535 Chestnut St.

Joline, Hon. Charles Van Dyke,
The Robeson,
Camden, N. J.

Jones, Mrs. Cora A.,
969 North 6th St.

Jones, Mr. Horace C.,
"Hedgeley,"
Conshohocken, Pa.

Jones, Mr. Joshua R.,
2051 Walnut St.

Jones, Miss Kathryn Riter,
The Newport,
16th and Spruce Sts.

Jones, Miss Lillian C.,
4107 Locust St.

Jopson, Miss Eleanor E.,
334 South 16th St.

Kaler, Miss Mary M.,
30 West Girard Ave.

Kane, Mr. Francis Fisher,
1024 Clinton St.

Kates, Mr. J. Louis,
217 North 34th St.

Keely, Dr. Robert N.,
Brown's Mills, N. J.

Keen, Miss Dora,
1729 Chestnut St.

Keen, Mr. Edwin F.,
62 North Second St.

Keen, Miss Florence,
1729 Chestnut St.

Kelly, Miss Agnes M.,
1924 North 24th St.

Kelly, Mr. Edward Smith,
1528 Pine St.

Kelsey, Dr. Ernest W.,
1217 Spruce St.

Kennedy, Mr. Frank G., Jr.,
808 North American Bldg.

Kercher, Mrs. D. E.,
1927 South 18th St.

Kerr, Mrs. Samuel T.,
1907 Spruce St.

Kershaw, Mr. William,
215 East Penn St.,
Germantown.

Kieran, Rev. Wm., D.D.,
242 South 20th St.

Kimball, Mrs. Wm. S.,
404 South 42d St.

Kimes, Miss L. E.,
2245 Franklin St.

Kind, Mr. Henry W.,
4447 North Uber St.

Kinsey, Miss Mary M.,
2029 DeLancey Place.

Kirkbride, Mrs. Thos. S.,
1406 Spruce St.

Klahr, Miss Emma,
3d and Dauphin Sts.

Klemm, Mrs. George F.,
1618 Jefferson St.

Klemm, Mr. Howard S.,
2022 Tioga St.

Klemm, Mr. John W.,
3504 Hamilton St.

Kneass, Dr. Samuel S.,
1510 Walnut St.

Kneass, Mr. Strickland L.,
418 South 15th St.

*Knight, Mr. D. Allen,
129 East Mt. Pleasant Ave.,
Mt. Airy.

Koenig, Miss Lillian E.,
1714 North 20th St.

Krafft, Mr. Wm. de,
148 Manheim St.,
Germantown.

Krouse, Miss Amelia L.,
1605 North 9th St.

Kuehnle, Mr. C. Albert,
Noble, Pa.

Küsel, Dr. George C.,
1831 Chestnut St.

Lautenbach, Dr. Louis J.,
1723 Walnut St.

Lea, Miss Nina,
2000 Walnut St.

Leas, Mr. David P.,
302 Drexel Bldg.

Le Bar, Mr. Frank,
409 Chestnut St.

*LeBoutillier, Mr. Roberts,
Wayne, Pa.

*LeBoutillier, Mrs. Roberts,
Wayne, Pa.

*LeBoutillier, Dr. Theo.,
216 South 20th St.

*LeBoutillier, Mrs. Theo.,
216 South 20th St.

Lee, Mrs. Horace H.,
3800 Chestnut St.

Lee, Mr. Ivy L.,
Broad Street Station.

Leedom, Mr. Charles,
N. W. Cor. 20th and Cherry Sts.

Leedom, Mr. E. C.,
216 West Rittenhouse Square.

Leeds, Mr. Arthur N.,
5321 Baynton St.,
Germantown.

*Lehman, Miss Emily,
1718 Arch St.

Leonard, Mr. Frederick M.,
4243 Walnut St.

Lewis, Mrs. Lynne K.,
2204 Tioga St.

*Libbey, Professor W.,
Princeton, N. J.

Lingelbach, Professor Wm. E.,
University of Pennsylvania.

Lippincott, Mr. Craige,
227 South Sixth St.

Lippincott, Miss H.,
Box 33,
Riverton, N. J.

Lippincott, Mr. Henry H.,
Cinnaminson, N. J.

*Lippincott, Mr. Howard W.,
1627 Spruce St.

Lippincott, Mr. J. Bertram,
1712 Spruce St.

Lippincott, Mrs. J. Bertram,
1712 Spruce St.

Lippincott, Dr. J. Thomas,
1433 Walnut St.

Livezey, Mrs. Maurice P.,
275 Harvey St.,
Germantown.

Livezey, Miss Sarah M.,
3726 Hamilton St.

Lloyd, Mr. William S.,
5901 Wayne Ave.,
Germantown.

Lodge, Mrs. L. K.,
Media, Pa.

Long, Mr. George V. Z.,
1319 Castle Ave.

Long, Mr. Oliver N.,
3d and Ontario Sts.

Long, Mr. William H.,
3d and Ontario Sts.

Longcope, Mr. Thomas M.,
Lansdowne, Pa.

Longenecker, Mrs. Jerome,
3409 Spring Garden St.

Longstreth, Mr. C. A.,
228 Market St.

Longstreth, Mr. Edward T.,
11th St. below 69th Ave.,
Oak Lane.

Longstreth, Mr. Howard,
1823 Spruce St.

Loudenslager, Hon. H. C.,
Paulsboro, N. J.

Luckenbach, Mr. Frank L.,
2215 North 22d St.

Lumb, Major Chas. I.,
The Delmar,
Germantown.

Lummis, Mr. George O.,
6701 North 6th St.,
Oak Lane.

Lupton, Mr. Edward A.,
5116 Newhall St.,
Germantown.

Lyman, Mr. Benj. Smith,
708 Locust St.

Lytle, Dr. I. Walter.
1527 North 20th St.

MacAlister, Mr. James, LL.D.,
4031 Walnut St.

MacCalla, Mr. Willard A.,
237 Dock St.

McCain, Col. George Nox,
4008 Pine St.

McCape, Mrs. C. J.,
4806 Springfield Ave.,
Care Mr. E. S. Zieber.

McClain, Dr. John A.,
4814 Baltimore Ave.

McCreight, Miss M. Esther,
409 Chestnut St.

McDevitt, Rev. Philip R.,
St. John's Rectory, 21 South 13th St.

McFadden, Mr. John H.,
121 Chestnut St.

McKinley, Mrs. Frances T. P.,
608 Chestnut St.

McKinley, Mrs. Wm. A. A.,
4048 Walnut St.

McKinney, Mr. H. N.,
300 Chestnut St.

McKnight, Mr. William,
754 South 18th St.

McLaughlin, Mr. Wm. H.,
2243 North Franklin St.

McNeely, Mr. George H.,
170 North 4th St.

McQuillen, Mr. John H.,
6411 Overbrook Ave.

Magee, Mr. George W.,
6388 Overbrook Ave.

*Maitland, Miss Virginia.
417 W. Upsal St.,
Mt. Airy.

Malone, Mrs. E. B.,
The Rittenhouse,
22d and Chestnut Sts.

Manning, Miss Ada C.,
910 North 63d St.,
Care Mrs. F. Manning.

Maris, Mr. Thomas R.,
Care Amer. Bank Note Co.,
410 Sansom St.

Marshall, Mr. Alfred,
24 West Girard Ave.

Marvin, Mr. Sylvester S.,
Bryn Mawr, Pa.

Mason, Mr. Sidney,
Aldine Hotel,
Chestnut above 19th St.

Massey, Miss E. E.,
2018 Vine St.

Massey, Miss Mary,
1826 DeLancey St.

Masters, Miss Jessie W.,
3308 Baring St.

Matlock, Miss Ellen L.,
78 Broad St.,
Woodbury, N. J.

Matthews, Mr. C. J.,
417 Arch St.

Mayer, Mrs. Robert,
136 West Delphine St.,
Olney.

Mercer, Mr. Henry C.,
Doylestown, Pa.

Mershon, Mrs. Abner Henry,
The Newport,
16th and Spruce Sts.

Michener, Miss M. Anna,
4512 Regent St.

Miles, Mr. Edward S.,
314 South Broad St.

Miller, Mr. Benjamin,
420 West School Lane,
Germantown.

Miller, Mrs. George D.,
313 North 33d St.

Milne, Mr. Caleb J., Jr.,
2029 Walnut St.

*Milne, Mr. David,
2030 Walnut St.

Mitchell, Mr. Benj. W., Ph.D.,
Boys' Central High School.

Mitchell, Dr. J. Nicholas,
1505 Spruce St.

Mitchell, Miss Mary A.,
4405 Pine St.

Mitchell, Mr. W. K.,
29th and Ellsworth Sts.

Mitchell, Mr. Wilson,
262 South 17th St.

Mohr, Mr. J. Jacob,
Bullitt Bldg.

Mohr, Mr. James N.,
Bullitt Bldg.

Monroe, Mr. Edwin Pear,
408 Lippincott Ave.,
Riverton, N. J.

Monsen, Mr. Frederick I.,
614 North 136th St.,
New York City.

Montgomery, Miss Mary,
Overbrook.

Moody, Mr. Carlton M.,
1119 North American Bldg.

Moon, Mr. William H.,
Morrisville, Pa.

Moore, Mrs. Alfred F.,
1921 Walnut St.

Moore, Miss Anna L.,
29 North Highland Ave.,
Lansdowne, Pa.

Moore, Rev. Henry McKnight,
4021 Walnut St.

Moore, Mr. James S.,
Cynwyd, Pa.

Moore, Dr. Wm. H.,
1002 North 6th St.

Morgan, Mr. John B.,
235 Chestnut St.

Morris, Mr. Charles,
2223 Spring Garden St.

Morris, Miss Kate,
2223 Spring Garden St.

Moss, Mr. Frank H.,
627 Walnut St.

Motteram, Mr. Wm. C.,
1504 Willington St.

Muckle, Col. M. Richards,
1722 Pine St.

Murdoch, Mrs. Sarah K.,
46 Potter St.,
Haddonfield, N. J.

Murphey, Mrs. Joseph Chew,
5028 Cedar Ave.

Murphy, Miss Letitia C.,
1719 Fairmount Ave.

Murphy, Mr. Walter L.,
The Belgravia,
1811 Chestnut St.

Murphy, Mrs. Wm.,
The Belgravia,
1811 Chestnut St.

Murray, Miss A. V.,
1902 Green St.

*Murray, Mr. Joseph W.,
220 South Broad St.

Myers, Dr. Jane V.,
Cynwyd, Pa.

Myers, Miss Virginia,
1727 North Marshall St.

Nassau, Mrs. Charles F.,
1515 Wallace St.

Neall, Mr. Frank L.,
2520 Mermaid Lane,
Chestnut Hill.

Neall, Miss Marie A.,
F. 102 Hamilton Court,
39th and Chestnut Sts.

Nelson, Miss Katharine,
267 Sumac St.,
Wissahickon.

Nevin, Mrs. Charles W.,
Riverton, N. J.

Newbold, Mr. Clement B.,
1313 Locust St.

Newcomer, Mr. Edwin B.,
315 North 33d St.

Newhall, Miss Abby,
4048 Spruce St.

Nichols, Miss Ida C.,
3210 Montgomery Ave.

Nieweg, Miss Pauline K.,
1606 North Franklin St.

Noble, Miss Margaret,
5420 Media St.

Nolan, Professor Thomas,
Dept. of Arch.,
University of Penna.

Nudd, Mr. Howard W.,
3217 Monument Ave.

O'Daniel, Dr. Andrew Allison,
1338 Walnut St.

Palmer, Dr. Edward A.,
1311 North Broad St.

Palmer, Dr. E. Carlton,
1311 North Broad St.

Pancoast, Mr. Charles R.,
Heed Bldg.,
1215 Filbert St.

Parke, Dr. William E.,
1739 North 17th St.

Parker, Miss Annie R.,
1008 Green St.

Parker, Mr. Willard,
317 South 12th St.

Parry, Miss Kate S.,
1718 North 15th St.

Pascoe, Mrs. Chas. H.,
2602 North 11th St.

Patten, Miss Alice M.,
Rosemont, Pa.

*Patterson, Miss Laura E.,
2352 North Broad St.

Patterson, Miss S. E.,
712 Land Title Bldg.

Patton, Miss Elizabeth R.,
2021 Poplar St.

Paul, Mr. Mickle C.,
3310 Baring St.

Peacock, Miss Mary Craig,
Torresdale, Pa.

Pearsoll, Miss Henrietta W.,
Valley Road,
Ardmore, Pa.

Pechin, Miss L. S.,
243 South 13th St.

Peirce, Mr. Harold,
222 Drexel Bldg.

Penniman, Mr. J. H.,
4326 Sansom St.

Pennington, Miss Mary E.,
St. Davids, Pa.

Pennock, Mrs. Aldrich J.,
Lansdowne, Pa.

Perkins, Mrs. George H.,
413 South Broad St.

Perot, Mrs. Effigham,
Ardmore, Pa.

Pew, Mr. J. N.,
Bryn Mawr, Pa.

Pharo, Mrs. Albert E.,
Rutledge, Del. Co., Pa.

*Phillips, Mr. Abram L.,
1828 Mt. Vernon St.

Pickering, Mr. Chas. W., Jr.,
2027 Locust St.

Pollock, Mr. W. C., Jr.,
1727 Montgomery Ave.

Pollock, Mrs. William C.,
1727 Montgomery Ave.

Porter, Mr. Isaac, Jr.,
4809 Regent St.

Potts, Mr. Franklin M.,
Media, Pa.

Powell, Mr. Harry W.,
409 Chestnut St.

Prichard, Miss Margaret S.,
128 West Washington Lane,
Germantown.

Prince, Mr. Geo. Carson,
428 South 42d St.

Quick, Mr. Wm. H. W.,
4023 Pine St.

Quinn, Mr. Charles,
3922 Sansom St.

Rahn, Mr. C. E.,
410 Walnut St.

Rainier, Miss Mary S.,
1718 North 15th St.

Ramsay, Mrs. M. W.,
115 South 16th St.

Rau, Mr. William H.,
13th and Chestnut Sts.

Rawle, Mr. Wm. Brooke,
230 South 22d St.

Read, Mrs. Frank, Jr.,
2037 Chestnut St.

Reese, Captain Beynon D.,
2403 Spruce St.

Reid, Mr. P. G.,
4839 Pulaski Ave.,
Germantown.

Reiff, Mrs. Sarah A.,
754 North 20th St.

Reilly, Mr. Garrett L.,
2015 DeLancey St.

Remington, Dr. Jos. P.,
1832 Pine St.

Richards, Dr. Florence Harvey,
1802 Catharine St.

Rieger, Mr. George W., Jr.,
1855 North Marvine St.

Ringe, Mr. Henry Ralph,
3604 Walnut St.

Rittenhouse, Mr. Jos. G., Jr.,
1120 Arcade Bldg.

*Roberts, Mrs. Charles,
Haverford, Pa.

Roberts, Mr. Thomas,
116 South Front St.

*Robinson, Mr. Anthony W.,
409 Chestnut St.

Robinson, Mrs. Louis B.,
6342 Drexel Road.

Robinson, Dr. W. D.,
2012 Mt. Vernon St.

Robinson, Mr. V. Gilpin,
Clifton Heights,
Del. Co., Pa.

Robinson, Mrs. V. Gilpin,
Clifton Heights,
Del. Co., Pa.

Rogers, Mrs. Cornelia M.,
239 South 41st St.

Rogers, Miss Jennie W.,
The Willard,
1921 Arch St.

Roseman, Miss Lillian,
1839 Van Pelt St.

Ross, Mr. T. Edward,
Ardmore, Pa.

Rothermel, Mr. John G.,
Wagner Free Institute.

Rothermel, Mrs. P. F., Jr.,
2013 Walnut St.

Rowland, Mrs. Wm. N.,
Bridgewater,
Bucks Co., Pa.

Ruch, Mrs. William C.,
1705 North Park Ave.

Rudolph, Miss A. Adele,
3015 Diamond St.

Rumsey, Mrs. Carroll L.,
6817 Quincy St.,
Germantown.

Sailer, Mr. John,
2039 Spruce St.

*Sartain, Dr. Paul J.,
212 West Logan Square.

Saunders, Miss Jennie C.,
Bethayres, Pa.

Saunders, Miss Martha M.,
1810 Jefferson St.

Saunders, Mr. Robert L.,
1717 Oxford St.

Sayre, Mr. Alfred V.,
2332 Park Ave.

Sayre, Mr. Louis K.,
C. M. T. High School.

Sayres, Mr. Edward S.,
1825 Spruce St.

Sayward, Miss S. Janet,
Overbrook, Pa.

Scattergood, Mr. J. Henry,
3515 Powelton Ave.

*Schaffer, Mrs. Chas.,
200 Penn St.,
West Chester, Pa.

Scheeler, Mr. I. F.,
P. O. Box 415.

Schumo, Mr. S. L.,
880 North 22d St.

Scott, Mr. Norris A.,
Moylan P. O.,
Del. Co., Pa.

Scott, Mr. Norris J.,
Moylan P. O.,
Del. Co., Pa.

Scull, Mrs. C. K.,
Elkins Park, Pa.

Searing, Miss Alberta A.,
3800 Locust St.

Serrill, Mr. Wm. J.,
Haverford, Pa.

Shaw, Miss Mary B.,
15th and Esrey Sts.,
Chester, Pa.

Sheldon, Mr. Winthrop D.,
Girard College.

Shelmire, Mr. Chas. W.,
69th St. and Lawnton Ave.,
Oak Lane.

Shepard, Mrs. Lula M.,
3505 Baring St.

Shinn, Mrs. James T.,
313 South 41st St.

Shoemaker, Mr. Charles J.,
2029 Arch St.

Shoemaker, Mr. Owen,
2011 Chestnut St.

Shoenberger, Miss Mary L.,
4014 Spruce St.

Shrigley, Mr. James B.,
The Tracy,
36th and Chestnut Sts.

Shrigley, Mr. John M.,
Lansdowne, Pa.

*Shryock, Mr. W. A.,
209 South 6th St.

*Shryock, Mrs. W. K.,
209 South 6th St.

Shulze, Mr. Chas. A.,
4333 Pine St.

Silliman, Mrs. Estelle Day,
The Covington,
37th and Chestnut Sts.

Silliman, Miss Phebe C.,
Girard College.

Simpson, Miss Sarah F.,
2217 Frankford Ave.

Simpson, Mrs. William, Jr.,
P. O. Box 105, Overbrook, Pa.

Siner, Miss Emma W.,
6024 Wayne Ave.,
Germantown.

Skinner, Dr. Henry,
Academy of Natural Sciences.

Smaltz, Miss Elizabeth F.,
1522 North 16th St.

Smaltz, Mrs. Jos. E.,
1522 North 16th St.

Smith, Mr. Edmund N.,
1922 North 18th St.

Smith, Mrs. Fanny Mitcheson,
1515 Green St.

Smith, Mr. J. L.,
27 South 6th St.

Smith, Dr. J. Russell,
Logan Hall,
University of Penna.

Smith, Miss Wuanita,
1919 Wallace St.

Smyth, Miss Bertha V.,
2128 Vine St.

Smyth, Miss Martha,
411 High St.,
Germantown.

Snively, Rev. S. E., M.D.,
63d and Market Sts.

Snow, Miss Laura E.,
1815 Columbia Ave.

Snyder, Mr. John M.,
Elkins Park, Pa.

Sommer, Miss Elizabeth,
862 North 41st St.

Sowden, Mr. Lee,
Wissahickon & Midvale Aves.,
Germantown.

Spackman, Mr. Samuel,
Care Claude A. Simpler, Esq.,
Land Title and Trust Co.

Spear, Mrs. James,
The Aldine,
Chestnut St. above 19th.

Spear, Mr. James, Jr.,
1014 Market St.

Stambach, Mr. S. P.,
Haverford, Pa.

Stead, Miss Anna,
2736 North 11th St.

Steinmetz, Mr. Joseph A.,
6636 Greene St.,
Germantown.

Stewart, Miss Grace D.,
664 Union St.

Stewart, Mr. Henry C.,
842 North 20th St.

Story, Mrs. Henry Newman,
1533 Poplar St.

Stratton, Miss Rose J.,
2102 Green St.

Stretch, Miss Carolyn W.,
1623 North 18th St.

String, Mr. Wm. Paxson,
2436 North 30th St.

Stuart, Mr. Homer H.,
Care Fairbanks Co.,
701 Arch St.

Swayne, Mr. A. Canova,
45 East Greenwood Ave.,
Lansdowne, Pa.

Sweeny, Mrs. Frances D.,
3248 Chestnut St.

Tatnall, Mr. James E.,
Haverford, Pa.

Tatnall, Mr. Samuel A.,
503 Hansberry St.,
Germantown.

Taylor, Miss Anna Curtis,
816 North 21st St.

Taylor, Mr. Ceylon B.,
6312 Overbrook Ave.,
Overbrook.

Taylor, Mrs. Charles F.,
1932 North 13th St.

Taylor, Mr. Chas. M., Jr.,
The Gladstone,
11th and Pine Sts.

Taylor, Dr. John J.,
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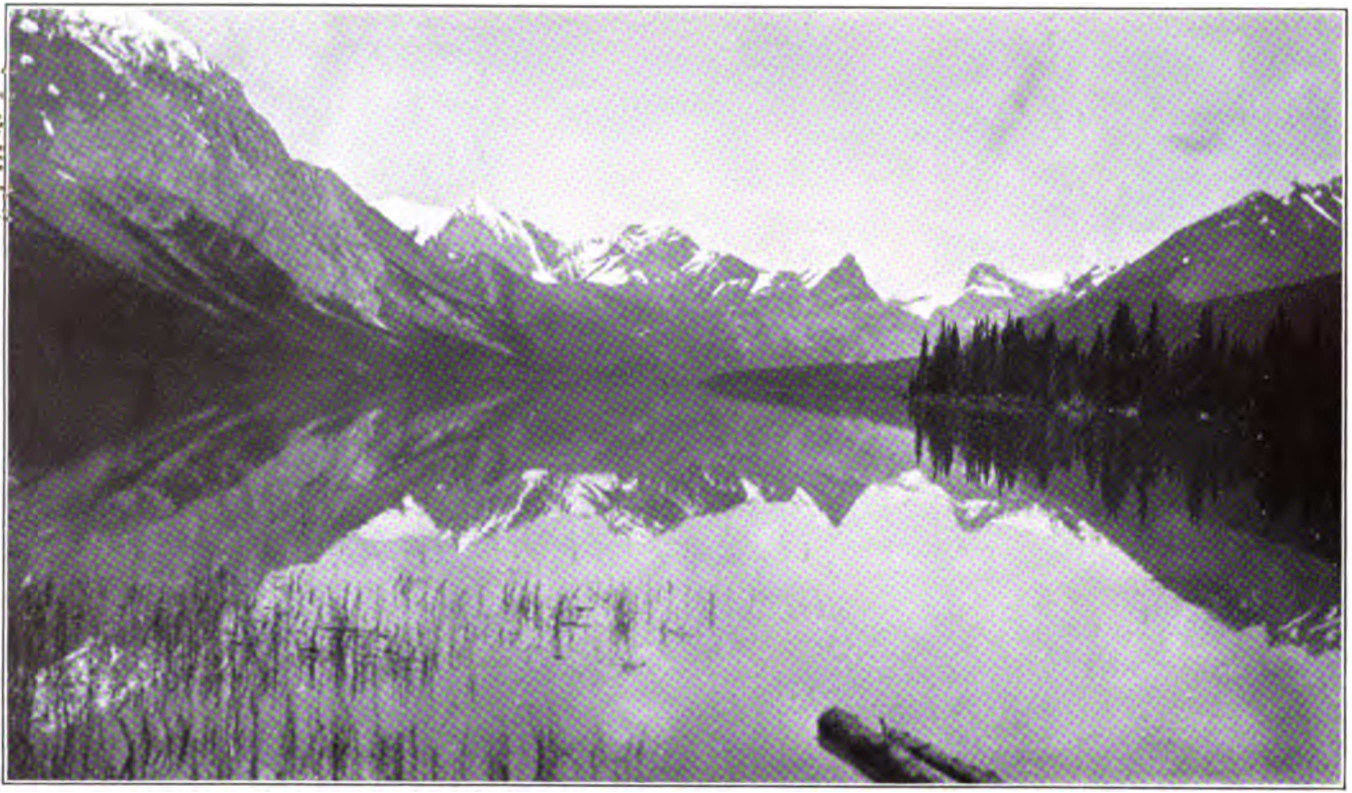

Lake Maligne.

A RECENTLY EXPLORED LAKE IN THE ROCKY RANGE OF CANADA.

Mary T. S. Schäffer.

In the summer of 1907 we heard through a hunter, of the existence of a large lake lying north or northwest of Brazeau Lake and Brazeau Mountain.[1]

When Dr. Coleman made his partial ascent of this mountain in 1898, he reached an altitude of 10,500 feet, but I presume he was following the southern or southeastern slopes, and consequently the lake did not come within his vision.

The Stoney Indians had spoken with great enthusiasm to "Jim," of a large lake (calling it Chaba Imne—Beaver Lake), and he knowing our love of penetrating to new and untried places, had passed the information to us. The early September snows of that year, however, prevented any climb at the head of the Brazeau sufficiently high to allow of a view into valleys beyond, and reluctantly the quest was abandoned for that year.

On our way back to civilized lands we halted a few days on the Saskatchewan Plains—about sixty-five miles north of Laggan—and were fortunate enough to fall in with Sampson Beaver, a Stoney, whom we promptly questioned regarding the mythical lake.

Indians have little desire to give the secrets of their hunting-grounds to the white man, but after two years' acquaintance with us, Sampson had evidently decided that the two white women were not rival sportsmen. A few tactful questions from the guides, a sharp rebuke from another member of our party, for suggesting payment for his information (when he had already had a generous supply of our scanty provender), he quickly sketched a crude map of the desired section, and gave us sundry advice on the subject in still more crude English.

On the eighth of June, 1908, with three guides, a botanist, ourselves, and twenty-two horses, we again ventured into the wilderness north of Laggan, armed with the little map, and the unknown lake a prime feature of the expedition.

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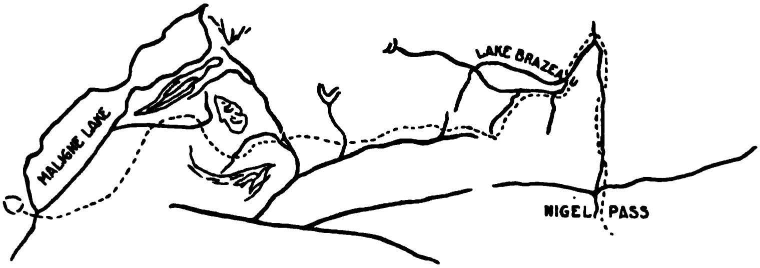
[1] See Bulletin Geog. Society Phil., Vol. 6, No. 2, 1908.

Our route lay over the now familiar Bow Pass, which owing to our early start, was still heavily clad in the winter's snow, thence down Bear Creek to its junction with the Saskatchewan, and then up the east side of the North Fork of the Saskatchewan to its junction with Nigel Creek. Here we bore to the right, ascended Nigel Creek on its south side, traversed the pass of the same name, and dropped to the head waters of a branch of the Brazeau River.

Camping at an old, well-frequented Indian camp-ground two miles below the lake, our men explored some distance ahead, to see if the way was passable for horses—as Dr. Coleman is the only explorer of that section on record, he having crossed Pobokton Pass in 1892.

The trail was found very readily, with Dr. Coleman's cuttings quite distinct, as well as some very old blazes, which proclaimed it a long-favored Indian highway. The lake was crossed at its mouth where the ford was but three and a half feet deep—surprisingly shallow for a body of water six miles long and a mile wide.

From there a sharp ascent was made to overcome some obstructing cliffs on the lake-shore with as sudden a drop to the lake, where we encountered a half mile of bad muskeg. Having successfully surmounted that trail, the way became well defined and led in easy gradations for some time toward the pass.



THE INDIAN'S MAP.

Horse-feed however was scarce throughout the entire valley, and was only obtained in moderate quantities at 6,300 feet where we camped. The ascent to the summit of Pobokton Pass from that camp proved excessively steep, and furthermore the entire pass was still clogged with heavy snow-patches into which the saddle-horses plunged and struggled as they broke a way for the sixteen laden packs following.

The descent on the other side was tedious and heavy for the animals, as the mountains on every side were discharging huge volumes of water from the melting snows.

It was at this time we should much have preferred Sampson to his rather indefinite map; and that we ever did strike the trail which eventually led us to our destination, was due rather to the dogged persistence and determination of our men, than to any very clear ideas expressed in the little sketch-map.

I suppose we trudged down that trail for at least eight miles, when we came suddenly upon a large bunch of teepee-poles standing in a grove of spruce. Here the river-trail died out, but finding fresh blazes on the hillside we followed them.

Evidently that section has been a good hunting-ground in the past, and evidently also a small party had been that way within a year or two. Hearts did not beat very high however for two or three days there; it looked too much like a lot of time and energy spent, with failure in the end.

On, on we climbed, with occasional glimpses of the river far below. At last when people and animals alike were fagged out with the long day, we came to an apology for feed in an alpine valley.

When camp had been set, three started out in three different directions to see if any point of vantage would show the mysterious lake, or if a presumable valley lying near our camp could be the one traced on Sampson's map. All returned with the dismal intelligence that the valley was a blind, and no lake to be seen from the highest point reached. We felt slightly discouraged. I might here quote from my diary: "July 4th—Last night depression reached its lowest ebb. No lake and little feed for the horses. Ther. at 30°, and such a wind blowing, that the tent, air-beds, and occupants threatened to depart into the valley below, nothing but pegging, reinforced by rocks preventing such a catastrophe. Woke at 6.30 to the call of 'hot-water,' and finally mustered courage to creep from beneath the warm blankets. The glorious 4th! I can hear the patriotic youngsters at home, I can imagine the hot sun! And here are we with the aneroid registering 7,250 feet, with great fleecy clouds rolling and rushing across the sky from the valley of the

Su Wapta! and reaching our eyrie, whipping and lashing us with their millions of flakes."

That day's travel led us for six or seven miles through fatiguing burnt timber, till reaching the bed of the river once more, we again struck teepee-poles. Here the trail divided, one going on down the Pobokton, the other turning sharply into a notch of the hills. Dr. Coleman must have followed the former, the latter I have every reason to believe, no white foot had ever trod before.

The recently-cut blazes were undoubtedly Indian, the trail good, and grass plenty. In a half hour, with blankets, packs and garments soaked by a generous downpour, we halted by a musical stream and, out of compliment to the day, named valley and creek "Independence." The next day was devoted to exploring by some, and botanizing by others. In the evening when all gathered around for bacon, bannock and coffee, it was announced that there was a pass leading off from the left of Independence Valley, there was a well-marked trail leading to it, and there were teepee-poles a half mile beyond our own camp. Was it the one Sampson had sketched? Well, there was nothing to do but go and see, and we went.

Considering the altitude of the pass (7,300 feet), and the amount of snow still covering it, the heavily loaded packs got through very well, this being largely due to the four saddle-horses ahead breaking the way. The summit proved a very short one, with a tiny frozen lake—probably one hundred yards long—nestling among the snow-banks at the top. As our horses slowly stumbled and plunged through the masses of soft snow, we had little time to think of their troubles, so busy were our thoughts and eyes rushing ahead to the unknown beyond. And then suddenly there burst upon us such a valley as I never saw before in this country of valleys.

From our very feet it streatched before us in limitless miles of green, green, green. As far as the eye could see there was not one hideous scar (of which there are so many in the Rockies), from fire. Out of the snow we waded down through fields of trollius, caltha and pulsatilla, halting finally where the first spring grasses had but recently sprung.

Dr. Coleman, in his account of the attempted ascent of Mt. Brazeau, mentions beholding a wonderfully green valley from his highest point of vantage, and calls it Pobokton. From later developments, and with our knowledge of both valleys, I think he was look-

THE TWENTY-FOOT BLUFF OVER WHICH WERE SAFELY TAKEN FIFTEEN HORSES.

A 300-YARD SWIM IN THE TORRENTIAL ATHABASCA.

ing into this one—the real Pobokton, owing to many old forest-fires, has few claims to beauty. The second camp in the valley was a memorable one for those who so long had been "hunting a needle in a haystack."

We were twelve miles from the new pass when we pitched our tents at the edge of a fine forest of spruce on July 7. All the morning we had passed signs of the hunter, and though we had covered the ground rapidly, every bend still opened up to us that limitless vista of green. At lunch our alpine-climber announced that "he meant to take the field-glasses and climb, and he wouldn't be back till he was assured whether that lake was within a radius of fifty miles of us or not." He kept his word. With the coming of the night, the anxious watchers could do nothing to aid him but keep a bright fire burning, and with the instinct of the hunter after plunging for two hours and a half through the black forest, he stumbled into the circle of firelight at 10.30, having walked twenty miles over the worst possible ground. He had eventually reached a point where his aneroid registered 8,750 feet, when the lake suddenly burst into view from a long valley at his feet, and he knew his hard walk was rewarded. To him had come the glory of the beautiful find, and I venture to say that all of the eager listeners wished they had been there too. The next day with light hearts we walked out upon the shores of Chaba Imne, whose opposite shores at this point were fully a mile apart and whose ends were not visible, owing as we thought at the time, to the impenetrable spruce and pine forests, which swept the water's edge.

Crossing the now somewhat formidable river which flowed through the green valley, a perfect paradise was found for the horses and busy hands turned to the construction of a raft to explore the lake. On the evening of the ninth we were informed that H. M. S. *Chaba* would sail at eight next morning for the upper end of the lake, provisioned for a three days' absence. My first experience on a raft, I felt it might be the last, but three days' life on her proved that nothing short of a water-spout could have wrecked her.

To our complete astonishment, the lake was so long that the whole three days were absorbed in rafting, not one left for climbing as we had hoped. We saw but one sign of human life along those miles of wooded shore, and that read of the passing of the hunter in the dead of winter. It was a three days' trip of as wonderful a panorama as could be imagined. Sampson had sketched "narrows" in the upper end of the lake (remember he was only a boy of fifteen when last he was there, and now a man of thirty-five); we found those narrows just where he had drawn them, and above them a towering rocky peak which we named for him. Emerging again into broader waters, we slowly paddled beneath the shadow of a snow-capped summit, when Unwin suddenly pointed to a high shoulder and said: "There is where I stood when I saw the lake first." How I envied him, and could only express my sentiments by suggesting the peak should bear his name.

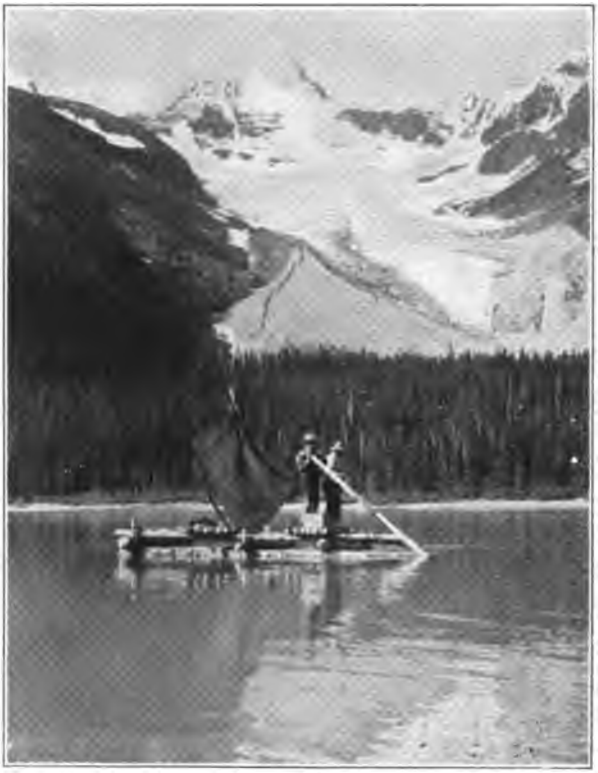
To our left loomed "The Thumb," and just beyond frowned down upon the strange invaders a double mass of rock which we called Mt. Warren. Among the lower peaks directly south of the lake rose a snowy pyramid which may be Mt. Brazeau, and to the east, an unusually superb mountain of conical form which if not Brazeau, we would call "Maligne." It was a keen disappointment that no certainty could be reached, as to the definite position of these peaks, but time and lack of food proved masters of the situation and we were forced to turn our backs on all this magnificence and return to the "grub-pile."

At the upper end, glaciers swept their long tongues to the lakeshore, streams of water from hidden snow fields reached the brink, and tossed themselves hundreds of feet over vertical cliffs, little deep green coves bade us slip among them and rest, but necessity called, and reluctantly and laboriously we paddled back to our horses and pork and beans.

Camping for a few days at the lower end of the lake, where by the way is an inexhaustible camp-ground, we calculated the sheet of water to be at least twenty miles long, found that a river which came from it, fell by steep and dangerous rapids for a length of twelve miles to Medicine Lake, and from there as Maligne River on the maps, flowed into the Athabasca about eleven miles away.

The Yellowhead Pass and Mt. Robson being our next points of interest our natural route was via Medicine Lake, but after several days of exploring and cutting, it proved impracticable.

Many years ago a forest fire, probably starting on the Athabasca, swept relentlessly up the entire valley, leaving scarce a tree standing, even a half mile of the west shore of the lake at its outlet being



H. M. S. Chaba, Probably the First Craft on Lake Maligne.
Mt. Unwin in background.

destroyed. Time and storms have left a network of fallen timber too great for so small a force as ours to cut through and the " longest way round " proved the shorter.

On the morning of July 24, with sunlight and cloud shadows chasing each other across the rippled surface of the lake, creeping up the green mountain slopes, and dying away behind the peaks, we said farewell to one of the fairest scenes that even we who have travelled so many of these valleys, have ever seen.

The long detour to the Athabasca was made through the valley we now call " Maligne," along the river and over the pass of the same name, then down through the fallen timbers and muskegs, which make the Pobokton one of the very worst valleys for traversing.

Dr. Coleman's trail that way in 1892 had long fallen in, and though he had done enormous cutting to get through, our men had troubles of their own. Once on the shores of the Athabasca, there came a parting of the ways. Mr. Brown, the botanist, and his guide, were to return to civilization via Wilcox, Nigel, Cataract and Pipestone Passes, we to go on for a glimpse of Mt. Robson, the highest known peak in the Rocky Range, then to flit down for a look at the present Tete Jaun Cache, before the Grand Trunk Pacific should annihilate the wilderness about it.

On July 29 we waved good-bye to our companions of seven weeks, weeks of pleasure and hardships, of sunshine and rain. With them they carried letters, our regrets at their going, a little longing for the news from the outside world which would soon be theirs, and a little pity that they would not finish the game with us.

Then followed days and miles of pleasant or weary travel down the right bank of the Athabasca. Undoubtedly this part of the river had formerly been much more used than the more familiar section further south. For many miles, however, the hunter's trail had died away almost to oblivion, and the most obvious signs of life were those of Dr. Coleman, the timber-cruiser and prospector.

Game trails were numerous, the ripped logs bespeaking bruin's presence, and the river sands marked by deer tracks, sheep, goat, lynx and the smaller animals. The flora changed perceptibly, as we were reaching much lower levels, and the large luscious strawberries made a delicious feast daily.

Within fifteen miles of the Miette, every sign of the trail vanished owing to the numerous fires of recent origin, so we plodded along, keeping close to the now wild, high banks of the river. There were few natural obstructions, and a horse could wander almost anywhere, so naturally we were puzzled to know where that trail had gone. But we certainly found out in due time why it was not near the river.

The banks became more and more abrupt, and we were forced to climb high, and yet higher on the mountain-sides to get around the impenetrable walls which rose sheer from the water.

On the sixth of August, as our outfit, dwindled now to fifteen horses, stood silhouetted against the deep blue sky, on a high bluff fully a thousand feet above the river, there came faintly on the breeze, the tinkle of a horse-bell. It sounds a small matter to set the heart beating with excitement, the pulses throbbing. But remember that for two months we had seen no faces but our own, heard no other voices, knew absolutely nothing of the outside world—and here was something and somebody. And as we listened, across the water came the sharp crack of a rifle. Was it Indian-hunter, prospector or surveyor? (for we were now within sight of the valley through which the Grand Trunk Pacific proposes to run its line to the coast).

Weeks after we met the man, an Indian, who fired the rifle. Though a mile and a half away from us in air line, he had seen our outfit against the sky-line, thought it was a fellow hunter for whom he was looking and signalled. At the time, with curiosity unsated, we went on our way, to have solved for us the problem we had asked ourselves so many times in the last thirty-six hours—"Where is that trail and why is it not beside the river?" The reason why was a rock bluff whose sheerest portion was twenty feet high. To go over that bluff or retrace a weary ten miles to the true trail, was a matter for the consideration of those of us who knew the limitations of a horse as mountain-climber. We took the bluff (not without some profound misgivings however). It was a highway for deer, and goat, and sheep, but the men who had come that way had turned about, preferring to search for the Indian trail which lay miles back in the stony hills. When the solitary white man, Swift, and the few half-breed Crees, who live a few miles below this point, heard our horses had been brought that way, they frankly disbelieved it, but photographs have proven the fact, that fifteen

The First Glimpse of Mt. Robson.

horses, minus all but their halter-shanks to which a long rope was attached, were one by one gently coaxed ten feet down a very steep portion of the bluff, and then prevailed upon to take the final plunge over almost vertical rocks to the soft ground twenty feet below.

It was rather curious to watch the individuality of each horse as he took his leap. The more intelligent the horse, the more difficult it was to prevail upon him to make the attempt. Neither could there be any force or insistence used; for once he had to be left to his own sweet will, as an excited slip or hurried plunge might easily hurl him on the jagged rocks, from whence he would plunge with risk of a nasty injury, to the depths below.

We had frequently wondered why the Maligne River ever received the ominous name it had. Like the question of the bluffs, we soon came across a practical answer. On attempting to cross the river at its mouth (it was about seventy-five yards wide), the force of the water was so great, no man could have swum, or animal have kept its footing in it. The second in command felled a tall spruce, throwing it across as a bridge; as it touched the water, the torrent gripped the reaching boughs, and before it could come to rest, grasped and hurled it with terrific force into the Athabasca, only a few yards away. This torrent doubtless loses much of its terrors toward autumn, for a well-marked trail leads down the bank and appears again on the opposite side. At first we were puzzled how to reach that bank so near and yet so far away, but remembering McEvoy's description of an underground outlet for Medicine Lake, the men explored and found that an easy crossing could be made about one and a half miles above the mouth of the river. This made a morning's hard work clearing a passage for the horses.

When the entire outfit was taken over it, we found it, though excessively steep and choked with fallen timbers, one of the most beautiful bits of trail we had seen for several days. In places the trail clung almost to the very brink—very wild and a little startling as one gazed from the saddle into the boiling, seething depths below—while a terrific roar and rumble swept over us which drowned all attempts at conversation. No one really wished to speak, it was too splendidly wild and interesting, and was also fraught with just sufficient danger, to cause us to keep a close watch on the already well-trained feet of our steeds.

After a climb of about six hundred feet, sure enough, there was the tiny stream so small we could almost have waded across it. Somewhere between that point and Medicine Lake it had dropped from sight, the greater volume of water to appear for the first time from the various strata of rock in the gorge just passed.

The crossing of the Athabasca by the human element of our party, was made in two dugouts lashed together, the horses being forced to swim three hundred yards in the ice-cold, rapidly-flowing river. It looked pretty dubious for the poor creatures, as with only noses and ears visible, we could hear them snorting and blowing, and laboriously fighting their way through the flood. Then as they emerged, spent and weary on the other side, and we counted fifteen tired horses slowly crawling up the bank, we all felt a just sense of relief. From now on we had McEvoy's government report, which is so clear and distinct in every detail, there can be no reason for duplicating what he has already so concisely explained.

Our crossing was made three miles below the Maligne River, opposite John Moberly's place. Moberly is one of the half-breed Crees who made for himself a little home on the east side of the sunny valley of the Athabasca, after Swift (a white man who went there fourteen years ago), had demonstrated that any crops of a temperate zone could be grown there. John was away at the time of our arrival, and Mr. Swift, hearing our rifle signal, paddled us across.

He was frankly astonished at our coming, especially as we denied being either "prospectors or timber-cruisers." And we were equally surprised at his cordiality and hospitality, which took the form of liberal donations of fresh milk, eggs, and new potatoes, all the result of his own labor on a small tract of land which he had wrested inch by inch from that northern wilderness. To appreciate fully such generosity, and to know the true value of such a gift, one needs to have had two full months' training of bannock and bacon three times a day. We shall long remember Mr. Swift, who is famous for his hospitality to all who pass his door.

The trail, in spite of its having been traversed nearly two hundred years ago by coast Indians crossing the Pass to trade with the fur companies, used in later years by explorers and prospectors, then by Canadian Pacific survey outfits, and recently by those from the Grand Trunk Pacific, we found in very bad condition.

Mt. Robson from Grand Fork.

Lake Maligne from the Lower End.

No effort seemed ever to have been made to lighten the hardships of the hundreds of horses which must have passed that way in the last thirty years. Muskegs, steep, bowlder-strewn, rocky hillsides and great logs across the trail were reasons enough for the piles of bleached bones which we daily passed on our way to the Tete Jaun Cache. But overlooking the misery, what a wonderful valley for berries it was! Not only were they there in plenty, but in quantities so great that for three days we passed carpets of a small and very delicious *Vaccinium* (blue-berry) which gave the ground the appearance of being blue. There were at least five other varieties of *Vaccinium,* strawberries, luscious raspberries, a trailing red black-berry, any number of the Saskatoon bushes, and on the western slope a small wild cherry.

Our first glimpse of Mt. Robson on the afternoon of August 18 is thus recorded in the little much-worn diary: "After the last five miles had been traversed, as it seemed three or four times over, we swung around a stony corner, and suddenly on our right there appeared a snow-clad peak. Not over impressive at first, surrounded on all sides by low, rocky hills, we could scarce believe we were looking at Mt. Robson. But that it does stand out "immeasurably supreme,"[2] there is no doubt, for there is nothing in the way of a peak for miles to detract from it. Neither was there one feature of foreground to beautify it till we reached Grand Fork a couple of miles down the valley. The forests about us had all been destroyed by fire, and between us and this giant among the hills, gaunt, burnt tree-trunks rose like threatening hands. The ground was arid and stony, the day intensely hot, and not a cloud in the sky to soften the ridge of white which cut with icy lines into the hard blue sky. Our horses were foot-sore and weary from the week's trip up the Miette and down the Fraser, and all of us a little too fagged perhaps to be instantly impressed."

Viscount Milton and Dr. Cheadle, two Englishmen who passed through this section on a hunting expedition in 1863, assert that the original Tete Jaun Cache (supposed to be the cache of a yellow-headed Indian) was situated at the junction of the Grand Fork and the main river. What their authority was they do not say, nor do I know if their statement is correct, how it ever got transplanted fifteen miles further down the Fraser river.

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[2] Milton and Cheadle.

It was with many doubts that a few days later we wended our way to the present cache, but curiosity had overcome our antipathy to a probable meeting with any stray surveyors or prospectors, and the one permanent resident of whom Mr. Swift had spoken in glowing terms.

What we found was one tiny log shack, a tent beside it, another tent a stone's throw away, four white men, and a few Indians from the village across the Fraser. The "resident" proved to be a Philadelphian, his companion originally from Boston, I think; at any rate their courtesy, cordiality and hospitality were worthy both those cities. We went dreading I know not what, we came away wondering when we would ever learn the lesson—that though nature may wrap a rough cloak about those who follow her footsteps, she purifies and refines the heart within.

We had wandered far, very far from home, certainly into the very depths of the wilderness itself, and were meeting the men who were grappling with the secrets of the country. They told us we were the first white women known to have crossed the oldest known pass in the Canadian Rockies, and one and all paid us as deep and kindly a homage as it has ever been ours to accept.

AN OUTLINE OF THE ECONOMIC CLIMATOLOGY OF BRAZIL.[1]

ROBERT DEC. WARD,

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Following Sâo Paulo on the south, the three states of Paraná, Santa Catharina and Rio Grande do Sul are usually grouped together under the general designation of "Southern Brazil." These are much alike in having great stretches of grasslands, interspersed with open woods, in the interior, with forested mountains on the coast. Cattle-raising, agriculture, forest industries and increasing manufacturing interests characterize these states. A considerable European immigration, chiefly German and Italian, has given the whole region a distinctive and highly progressive character. Many thoroughly German agricultural settlements have been formed, such as Blumenau, Neudorf, etc. Climatically, southern Brazil is a transition region. Both climate and vegetation become more and more subtropical to the south. Rio Grande do Sul, it should be remembered, extends beyond lat. 30° S. There is a gradual, but well-defined, decrease of temperature with increasing latitude. In the state of Sâo Paulo the mean annual temperatures average 64.5°–72°; in Paraná they fall to 61°–68°; in Rio Grande do Sul, even on the coast, they average 63°–64.5°. Frost becomes increasingly frequent to the south. On the southern higher campos water freezes on clear winter nights, and in Santa Catharina and Rio Grande do Sul cattle have been lost in snowstorms. The equatorial limit of snowfall here goes relatively far toward the equator.

The prevailing winds are S., S.W. and S.E. in the cool season, and more N. and N.E. in the warmer season. The northward extension of the *pampero* brings cool, damp S. and S.W. winds, with thunderstorms. There is no really dry season, although the winter months have, as a rule, the least rainfall. With increasing latitude, the contrast between the seasons decreases, the rainfall being more evenly distributed through the year, *i. e.,* the winters become more rainy towards the south.[2]

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[1] The first part of this article appeared in the BULLETIN for April.

From north to south, in southern Brazil, from Paraná to Rio Grande do Sul, there is a gradual decrease in agricultural products and an increase in the importance of the cattle industry. The floral map shows clearly that southern Brazil is distinguished by the presence of two characteristic plant forms, the *Ilex paraguayensis* ("Paraguay tea") and the Brazilian araucaria, which latter, often curiously mingled with scattering palms, distinguishes much of the southern campos country. The nuts of the araucaria furnish an important food. Araucarias reach, on the slopes of some of the coast mountains, nearly to the latitude of Rio de Janeiro, but do not become a characteristic feature of the campos landscape until the state of Paraná is reached. In Paraná, as compared with Sâo Paulo, the value of agricultural products falls greatly because the coffee belt has been left behind. Cattle, horses and mules become increasingly important, and *maté* rises, in Paraná, to the most prominent position. The common name for maté, "Paraguay tea," associates this plant with Paraguay, but Brazil is becoming a more and more important maté-producing country. When white men came to these parts of South America, the Indians were found to be drinking maté, and the Jesuit missionaries soon discovered the excellent properties of the plant and forthwith adopted the native custom of using it. The maté tree grows to be ten to twenty feet high; its natural habitat is on the plateaus 1,500 or more feet above the sea, and chiefly in Matto Grosso, Paraná and Paraguay. It is now extensively grown on plantations. Advocates of the use of maté as a drink, in place of tea and coffee, have gone very far in attributing to this herb medicinal, nutritive and stimulating qualities which would seem to make maté an absolute essential to health and happiness. The writer has before him at this moment a report on maté, made to a commercial and industrial body in Paraná a few years ago, and in this account the benefits to be derived from the use of maté tea are enumerated at great length. But whether these beneficial qualities are exaggerated or not, the fact remains that maté-drinking is very much on the increase, and that those who indulge in it are practically unanimous in stating that maté is far superior to tea, in not producing insomnia or nervousness. Americans who want to see a maté factory will do well to visit Curityba, the capital of the state of Paraná. There the "Fabrica Tibagy," one of the largest in Brazil, will be freely opened to their inspection. This factory exported last year 3,000,000 kilograms of maté, the whole amount exported from Paraná being 30,000,000 kilograms. The leaves and small stems are brought to the factory in burlap or rawhide bags, and after being thoroughly dried, in ovens, are passed through a screening process, which separates the stems and leaves, according to their size. The coarsest stems are used for fuel; the less coarse ones are sold for the cheaper grades of maté. The leaves are then carefully sorted, according to their quality, and are next run through crushing machines. The best maté is in the form of a very fine olive-green powder. Maté tea is prepared much like ordinary tea. It may be taken in a cup, if properly strained, but the native way is to leave the powder in the water and to suck up the tea through a tube provided at the lower end with a fine strainer. The taste of maté to the novice seems not unlike that of a very weak solution of hot turpentine. It is therefore safe to say that maté-drinking is an acquired taste for those who are accustomed to ordinary tea. Most of the Brazilian maté goes at present to the Argentine Republic, but some is already being exported to France.

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[2] Curityba has a mean annual rainfall of a little under 60 inches; Blumenau has a little over 60 inches; Pelotas has a little over 40 inches; Rio Grande do Sul (city), a little under 40 inches.

Besides the maté, the araucaria is valuable on account of its nuts and the lumber which it supplies; and the southern states also produce manioc, beans, sugar cane, tobacco, cereals, grapes, vegetables, hops, flax, bananas, rice, etc. In Santa Catharina great herds of cattle wander about in a half-wild state, over the campos, and in Rio Grande do Sul the cattle industry is the dominant one over the interior, with agriculture on the mountains near the coast. Southern Rio Grande do Sul has very much of the appearance of the Argentine pampas, with scattering cattle ranches. An extraordinary development of industries which depend upon the products of stock-raising has taken place in Rio Grande do Sul. Slaughter-houses, as in Pelotas and Rio Grande do Sul; and establishments for the preparation and use of the hair, hides, bones and horns; for the manufacture of soap and candles; for drying and salting beef and tongues, make up a long and a lengthening list. Sheep have thus far not been raised in large numbers. Other industries which depend directly upon the products of the soil, under climatic control, are sugar-mills; lumber mills; match, furniture, wagon and barrel factories; cigar factories, and the like.

At the Rio Exposition last year, as one looked over the exhibits from the states situated successively farther and farther south, the industries were seen to increase, until, in Sâo Paulo, Paraná, Santa Catharina and Rio Grande do Sul they reached their maximum variety and highest development. Those who have traveled in Germany saw unmistakable evidence of German skill and workmanship in the Santa Catharina exhibit of needlework and embroidery, baskets, furniture and woodenware, and oil paintings, and a copy of "Der Urwaldsbote," published in Blumenau, showed that the language of the Fatherland is not forgotten in the midst of the new surroundings of Brazil. The broadest generalization that one can give regarding the exhibits as a whole is that the southern states of Brazil are far ahead, industrially, of the central and especially of the northern states. This results naturally from the fact that the southern states have a far more extended railroad development and are—or rather because they are—settled by a large number of recent European immigrants. The exhibit of Rio Grande do Sul, the southernmost Brazilian state, adjoining Uruguay, must have been a revelation to every one who saw it. The writer's guide through this exhibit was a typical representative of the state. With French and German blood in his veins, but himself a thorough Brazilian, he took enthusiastic and wholly justifiable pride in pointing out the variety of the products and the excellence of the workmanship exhibited in the collection of articles sent by his state. These included articles of clothing of all kinds, of silk, cotton, woolen, linen and leather; straw and felt hats; furniture; leather and canned goods; soaps; perfumery and drugs; glassware; pianos and musical instruments; preserves and pickles; cigars and tobacco; articles of horn; books; artificial flowers; furniture; papers; brushes; beer and wine; flour; crackers of all sorts. It is clear enough that European manufacturers will soon have to meet strong competition here in Brazil. As the writer's guide proudly said: "We make just as good biscuit, and just as many varieties, as the English do."

The coasts of the Brazilian highland states have a warmer, damper and rainier climate than the elevated plateaus of the interior.

Dense tropical forests—practically an entension of the Amazonian forests—cover the seaward slopes of the coastal mountain ranges. The rainfall of the coast is generally somewhat heavier than that of the interior on account of the free exposure of the former, with its mountain ranges, to the easterly trade winds. Because of its peculiar position, Rio de Janeiro has a rather exceptionally small rainfall (just over 40 inches). Santos, which is more normal, has over 90 inches. In the interior the amounts are well below 80 inches. Sâo Paulo (city) has between 50 and 60 inches. Queluz, in the Parahyba valley, has about the same. Uberaba, in Minas Geraes, has about 70 inches. The temperatures on the coast are high.[8] The interior is cooler, and has somewhat greater ranges.

The climate of Rio is unquestionably favorable to the development of the *Anopheles* mosquito, and for long years yellow fever was prevalent in the city. But recently, through the strenuous efforts of the sanitary authorities, the disease has been practically driven out. At the little English Hospital, up on the hills above the city, the English nurses now talk about "the old days of the fever."

Petropolis, a delightful little town up among the Organ Mountains north of the capital, is still the permanent residence of the foreign ministers and consuls, and of many of the business men of Rio, but Petropolis need no longer rest its reputation upon the fact that to sleep there insures safety from yellow fever. Its cool nights, its attractive villas and gardens, and the charm of its society, amply suffice to insure its popularity in the future. The hour's sail across the bay on the four o'clock afternoon boat from Rio, with pleasant company, and the hour's ride up the cog-wheel road to Petropolis is still, as it has been for years, a delightful ending to a day in the hot, noisy streets of Rio. The fine residence quarters of Rio—Botafogo and Larangeiras—with the new boulevards extending all along the water-front from the business part of the city out towards the entrance to the bay, are attractive enough, but Petropolis still remains the favorite residence for the majority of foreigners. Theresopolis, which is also beautifully situated up among the Organ

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[8] Rio de Janeiro has a mean annual of 72.7°; a February mean of 77.7°; a July mean of 67.8°. The extremes are 97.7° and 55.2°. Santos, a little south of the tropic, has a mean annual of 71.8°; and means for the warmest and coolest months of 78.4° and 64.8°.

Mountains, above the heat and the fogs of the coast, is becoming increasingly popular as a place of residence.

Two short railroad trips, made by the writer in August last, furnished striking evidence of the climatic contrasts between the coasts and the interior of southern Brazil. The first, from Curityba, at an altitude of about 3,000 feet, to Paranaguá, at sea level, is made in about five hours. This is, without question, one of the most picturesque railroad journeys in the world. Starting from Curityba, which is situated in a typical campo region, in a cold early morning fog, and crossing the gently rolling, open campos to the east, the train crossed the coast range, or Serra do Mar, at an altitude of somewhat over 3,000 feet, within two hours. Descending the eastern or seaward slopes by a splendid series of tunnels, viaducts, and embankments, the train reached Paranaguá in about three hours more. The contrast between the campos and the sea-level conditions is remarkable. The seaward slopes of the mountains are densely covered with the most luxuriant vegetation. The trees are overhung with moss, creepers, and parasitic plants of all kinds. The undergrowth is a tangled mass of low shrubs, bamboos, and brakes. Palms, which are absent on the campos, are seen soon after commencing the descent. Then come banana trees, at first singly and scattering; then more and more thickly. On the lower slopes, and especially on the lowlands near sea level, sugar cane, banana groves, guavas, and papaws, furnish striking evidence of the change from the cooler and drier interior upland campos to the warmer and rainier seaward slopes where frost is unknown. The change in temperature and in humidity during the descent is very striking. It was significant that the freight consisted of cattle on the campos, while on the seacoast lowlands cars full of bananas were attached to the train.

A second case of marked climatic contrast was obtained on the railroad trip from Santos, the famous coffee port about 200 miles south of Rio de Janeiro, to the city of São Paulo, on the campos. This journey takes the traveler by an inclined-plane cable road up to an altitude of a little less than 3,000 feet in a horizontal distance of five miles across the Serra do Mar. The trip, while less picturesque than that from Curityba to Paranaguá, is well worth taking. On the seacoast lowlands there are flourishing plantations of bananas. As the train ascends the densely-wooded seaward slopes of the Serra the bananas are soon left behind, and after the crest is passed the well-known features of the campos are again met with. The best time to take this trip is on the 4.30 p. m. train from Santos, for it is then that the change from the hot, steamy atmosphere of Santos to the cool upper slopes and crests of the mountains is most striking. The rainfall on the seaward slopes of the Serra is very heavy. Some years it exceeds 160 inches, and the annual mean at the summit station is 140 inches. The mean temperature at the summit station is 64.4° as against about 72° at Santos. The engineers of the São Paulo Railway have an incessant struggle to keep their road in repair. The trip from Santos to São Paulo is well worth taking as an illustration of marvelous engineering work in the face of great odds. The whole side of the mountain up which the railroad runs is in places walled up with brick and masonry, and brick or concrete drainage ditches and canals have been built up and down and across the mountain slopes in all directions. One of the engineers of the road made the statement that the ambition of himself and of his colleagues is to know what becomes of every drop of water that falls on the seaward slopes of these mountains. Certainly this is a very good illustration of the control over railroad construction and operation which results from a heavy rainfall on steep slopes. To maintain this line, in good order, is one constant struggle against the destructive action of rain-water which is flowing downhill—nothing more—and, unfortunately for the railroad, nothing less! An old railroad line, the one first constructed and now replaced by the new one at a better grade, is kept open and ready for use in emergencies, in case the new line is washed out. Both the Paranaguá and Santos lines across the coast mountains of Brazil furnish excellent examples of sharp climatic contrasts between warmer, damper, and rainier seacoast lowlands, and cooler, drier uplands within a few miles of the sea but separated from the coast by mountains of moderate elevation.

We have already ventured to make certain predictions regarding the future of the great Amazonian lowland, but it seems to us that there is no more interesting question in Brazil to-day, from the point of view of the development of the country, than that which concerns the future of the great central and southern campos. What shall be done with them? Can they be made to produce good pasturage? Can they be used for cereals? Are they to be a farming country?

It is clear that the climatic conditions of the campos of southern Brazil are on the whole favorable for the future utilization of this immense area. The soil is also, in the main, good. Of course, conditions of climate and of soil vary in different parts of these campos. In some places the rainfall of the dry season is probably insufficient for agriculture without irrigation; in other places the soil is doubtless less fertile. But in the large, the Brazilian southern campos are better off than much of our western country which now yields good returns in cattle and crops. The replacement of the "goat's beard" tufted grass by the native "catingueiro" provides excellent pasturage for cattle and horses. When the former grass is burned off, the soil plowed or dug under, and the "catingueiro" planted, the latter has been able to maintain itself, especially where the rainfall is abundant. In some places European grasses have been successfully sown, and it is almost certain that with proper care alfalfa or some other supplementary forage crop can be raised, where necessary, in order to provide fodder during the dry season. As to cereals, it is too early to venture any reasonable forecast. Vegetables have succeeded well where proper care has been given them. Some light is thrown on the latent possibilities of the country by the success which has been attained at the government agricultural experiment station at Piracicaba in the state of Sâo Paulo. Professor J. William Hart, one of the corps of instructors at the station, reported to the writer that at this *Fazenda Modele* rather remarkable success has been attained in the cultivation of corn, barley, rice, cotton, alfalfa, and other crops. Experimental plantings of various kinds of wheat and corn from the United States are being made, and the people who come to the farm are being taught modern methods of farming and stock-raising.

There is also an experimental rice farm at Moreira Cesar, in the state of Sâo Paulo. On this farm, with the aid of irrigation, our fellow countryman, Mr. Wellman Bradford, of Louisiana, is carrying on an experiment station where students, selected by the government, are being taught scientific rice-growing. Mr. Bradford has had many difficulties to contend with in his work, but he has faithfully persisted in his undertaking, and deserves the greatest credit for his skill and perseverance. Japanese rice, which has lately been sown on this farm, has been found to give the best results as to quality of the crop. No more important work for the agricultural future of the great southern campos of Brazil is being done than that now in hand at the rice farm at Moreira Cesar, and at the Fazenda Modele at Piracicaba. Again, at a ranch owned by a Frenchman, not far from Ponta Grossa, similar success with many different kinds of crops is reported. The best utilization of the campos is simply a question of time, of hard work, and of continued experimentation with different kinds of crops. Experiment stations should be established at several different points on the campos, and at each station every effort should be made to discover what kinds of crops will succeed best. At present the people are acting largely without intelligence, even when they make an effort to raise vegetables or other crops. They are not adapting their crops or their labor, which is very haphazard, to the climatic conditions. Cereals can doubtless be found which will succeed, possibly without, possibly better with, irrigation. Certainly in the more southern parts of the campos, *e. g.*, over much of Paraná, there is abundant water for irrigating an immense number of farms, and further south the rainfall is more and more evenly distributed through the year, which is a great advantage.

No one who crosses these campos of southern Brazil to-day can for a moment doubt that the country has a splendid future. It may be almost wholly a cattle country; it may be most valuable for sheep raising; it may perhaps be best utilized for corn, or wheat. To the writer it seems likely that the campos of the states of Sâo Paulo and Paranà, and probably also of Santa Catharina and Rio Grande do Sul, might be best utilized as a country of farms, where horse and cattle raising will be supplemented by crops of alfalfa, sorghum, or corn for the animals, and of vegetables and some cereals for local consumption. Irrigation during the dry season will doubtless be found desirable, even necessary, in places. Climatic obstacles such as hailstorms, drought, sudden heavy rainfalls, and frost, must be reckoned with here, as in other parts of the world. The ants must be kept under. Prairie and forest fires must be prevented. Man nowhere finds himself without some such hostile manifestations of nature. Yet the cuts and embankments of the railroads of these campos are prophetic of the future. In imagination the traveler may already see the through trains between Rio de

Janeiro and Montevideo crossing the campos, and may picture to himself this wounderful country, now so striking an example of colossal waste, a settled, peaceful, and prosperous agricultural community. The southern states of Brazil are certain to attract increasing numbers of European immigrants, for the climate is favorable and the occupations are congenial. But these immigrants do not, and will not wish to, constitute the "German Peril" which so many Brazilians now fear. Industries of all kinds must develop, far beyond their present meagre importance, surprising and striking as this already is.

Brazil unquestionably has a splendid future. It is just as foolish to be pessimistic as it is to be hysterically optimistic regarding that future. The immense campos, which cover so much of Brazil, cannot possibly be developed in a hurry. They are not tropical forests, or gold mines, whose products can be secured in haste. Agriculture proceeds slowly. It will take long years of immigration and experimentation, and soil preparation, and much hard labor, to make these campos richly productive. An unknown, perhaps a not insignificant portion of the country, will prove scarcely arable—unproductive. He would, indeed, be a rash prophet who should attempt any definite forecast concerning the future. All that we have tried to do has been to suggest what seem to us to be reasonable probabilities. We have endeavored to give an outline of the economic climatology of Brazil.

NOTES ON AN EARLY AMERICAN ARCTIC EXPEDITION.[1]

HENRY G. BRYANT.

To students of arctic exploration, no one fact more frequently compels attention than the persistency with which northern explorers have sought to discover a North-west Passage.

The great Genoese navigator hoped to find a more direct route to Cathay when he undertook his momentous voyage from Palos and died in the belief that the lands he had discovered were part of the coast of Asia. The commercial incentive to reach the rich marts of the east by a North-west Passage was the impelling force which brought about the long series of voyages identified with the names of Cortereal, Verazzano, Davis, Hudson and Baffin. In spite of repeated failures, this quest was kept up with varying assiduity by successive generations of mariners. Sir Martin Frobisher—one of the earliest Englishmen to seek the short route to the Indies—wrote about 1576: "It is the only thing in the world that is left yet undone whereby a notable mind might be made famous and fortunate." To revive interest in the project, the British parliament in 1743 offered a reward of £20,000 to any English expedition accomplishing the passage from ocean to ocean. Over a hundred years were destined to pass before this premium was claimed during the era of the Franklin search enterprises, by Capt. McClure and his shipmates. The claim was only allowed in part as in this instance the passage from the Pacific to the Atlantic had not been made entirely in a vessel but partly by sledges across the ice of Barrow Strait.

With this exploit of McClure and with the commercial feasibility of the route disproved, doubtless those interested in this phase of Arctic achievement believed the last chapter had been written in the historic annals of the North-west Passage. The result has shown that more was still to be accomplished. Yet more than three centuries passed before the distinction of this discovery was conceded. The early years of the twentieth century witnessed the true realization of this centuries-old endeavor, when Captain Roald Amundsen, the intrepid Norwegian navigated his diminutive vessel the Gjöa through perils manifold, from the waters of the Atlantic to those of the Pacific ocean.

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[1] Read at the Ninth International Geographical Congress, Geneva, August, 1908.

Now that the achievement of the North-west Passage is an accomplished fact, and the time has arrived when the history of those famous voyages can be written in its entirety, I wish to submit some notes relating to what was probably the earliest American expedition scientifically planned to explore the arctic regions and whose avowed object was the discovery of the North-west Passage.

Following a long period of inactivity in Arctic research in England—and when we were still loyal subjects of his Britannic Majesty George II—this ambitious project was planned and consummated in the City of Philadelphia in the year 1753.

The City of Penn from its geographical position in the middle of the chain of colonies on the Atlantic coast, had developed along lines of material and intellectual progress to a commanding position among the British colonies of North America. As early as 1742 its public-spirited citizens had raised funds to send John Bartram, whom Linnæus had described as "the greatest natural botanist of the world" on an extensive collecting trip to Oswego and Lake Ontario in the present state of New York. That interest in this Arctic enterprise was not local is shown by the circumstance that merchants from Maryland, New York and Boston were among the subscribers to the expedition. As was to be expected, the alert and progressive Franklin was interested in the undertaking and in a letter to Jared Eliot, dated thirty-eight days after the departure of the vessel, wrote: "Our vessel, named the *Argo,* is gone for the North-west Passage; and the Captain has borrowed my journals of the last voyage."[2] Over two years later in a letter to Peter Collinson he expressed the intention of some day gathering together and sending to his friend all the papers and letters he had relating to the expedition.[3] Whether or not the philosopher carried out this intention does not appear, and it must be admitted that the available contemporary data bearing on the expedition are rather meagre. The pages of the *Pennsylvania Gazette,* published in Philadelphia by Franklin, contain several brief references to the undertaking; but the most circumstantial record of the voyage is contained in a work published in London in 1768 entitled "The Great Probability of a North-West Passage," by Thomas Jeffery. The author of this rather ponderous publication refers to the American expedition in his preface and reproduces in the appendix the most interesting part of the log of the commander, Capt. Charles Swaine, although strangely enough the name of this gentleman nowhere appears in the book.

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[2] "Life and Writings of Benjamin Franklin," by Albert Henry Smythe, Vol. III, p. 123.

[3] *Ib.,* Vol. III, p. 268.

From the above sources, we learn that the schooner *Argo,* sixty tons burden, with fifteen persons aboard, Charles Swaine, Master, sailed from Philadelphia on March 4, 1753, to discover the Northwest Passage which was believed at that time to lead from the western shore of Hudson Bay to the Pacific.

According to the preface of Jeffrey's work, the scheme of the expedition was a bold and comprehensive one for we learn that the *Argo* was "fitted out on a subscription of the merchants of Maryland, Pennsylvania, New York and Boston, on a generous plan, agreeable to proposals made them, with no view of any monopoly which they opposed. Not to interfere with the Hudson's Bay trade, nor to carry on a clandestine trade with the natives of Greenland, but to discover a North-west Passage, and explore the Labrador coast, at that time supposed to be locked up under a pretended right, and not frequented by the subjects of England, but a successful trade carried on by the French; to open a trade there, to improve the fishery and the whaling on these coasts, cultivate friendship with the natives, and make them serviceable in a political way."

The departure of a vessel on a voyage so charged with possibilities of adventure and discovery must have been an event of unusual interest in the annals of the quiet colonial city, and doubtless a throng of well-wishers assembled on that bleak day in early March to wish the voyagers Godspeed. We learn from the *Gazette* of May 10 that the *Argo* "having touched at Hiannas, near Cape Cod, and at Portsmouth, in New England, to take in her compliment of hands, and some particular necessaries, took her departure from the latter place on the 15th of April. All well on board and in high spirits."

No further news of the expedition was heard for more than seven months until the arrival of the *Argo* at Boston was reported on October 21. The issue of the *Gazette* of November 17 chronicles the return of the storm-tossed, little craft and gives an interesting *resumé* of the voyage. In the quaint phraseology of the period this reads as follows: "Sunday last arriv'd here the Schooner *Argo,* Capt. Charles Swaine, who sailed from this port last spring on the discovery of a North-west Passage. She fell in with the ice off Farewell, left the eastern ice, and fell in with the western ice in Lat. 58 and cruised to the northward to Lat. 63, to clear it, but could not, it then extending to the eastward. On her return to the southward, she met with two Danish ships bound to Ball River and Disco up Davis' Straits, who had been in the ice fourteen days off Farewell, and had then stood to westward, and assured the Commander that the ice was fast to the shore all above Hudson's Straits to the distance of forty leagues out, and that there had not been such a severe winter as the last these twenty four years that they had used that trade; they had been nine weeks from Copenhagen. The *Argo* finding she could not get round the ice press'd thro' it, and got into the Strait's mouth the twenty-sixth day of June, and made the island Resolution, but were forc'd out by vast quantities of driving ice, and got into a clear sea the first of July. On the fourteenth, cruising the ice for an opening to get in again, she met four sail of Hudson's Bay ships, endeavoring to get in, and continued with them till the nineteenth, when they parted in thick weather in Lat. Sixty-two and a half; which thick weather continued to the seventh of August; the Hudson's Bay men supposed themselves forty leagues from the western land. The *Argo* ran down the ice from sixty-three to fifty seven thirty and, after repeated attempts to enter the straits in vain as the season for discovery on the western side of the Bay was over, she went on the Labrador coast and discovered it perfectly from fifty six to sixty five, finding no less than six inlets, to the heads of all of which they went, and of which we hear they have made a very good chart, and have a better account of the country, its soil, produce &c. than has hitherto been published. The Captain says 'tis much like Norway; and that there is no communication with Hudson's Bay thr'o Labrador, where one had been heretofore imagined, a high ridge of mountains running north and south about fifty leagues within the coast.

In one of the harbours they found a deserted wooden house with a brick chimney, which had been built by some English, as appeared by sundry things they left behind; and afterwards in another harbour they met with Capt. Goff in a Snow[4] from London, who inform'd, that the same Snow had been there last year, and landed some of the Moravian brethren, who had built that house; But the natives having decoy'd the then Captain of the Snow, and five or six of his hands in their boat round a point of land at a distance from the Snow, under pretence of trade, and carry'd them all off (they having gone imprudently without arms) the Snow after waiting sixteen days without hearing of them, went home, and was obliged to take away the Moravians to help to work the vessel. Part of her business this year was to enquire after those men. Captain Swaine discovered a fine fishing bank, which lies but six leagues off the coast, and extends from Lat. fifty seven to fifty four, supposed to be the same hinted at in Capt. Davis's second voyage. No bad accidents happened to the vessel, and the men kept in perfect health during the whole voyage, and return'd all well."

Although unsuccessful in the main object of their quest, it must be admitted that these Pennsylvanians made a real contribution to the knowledge of the Labrador coast in exploring so considerable a stretch of its seaboard and in charting six of the numerous inlets which indent the coast. As is well known, the Labrador current carries "vast quantities of driving ice" and bergs down the coast during the spring months, making the navigation of the rugged Labrador coast almost impossible for small craft at that time. So well are these conditions known to-day, that the staunch little steamer which carries the mail along this coast is seldom dispatched from St. Johns, Newfoundland, on her cruise northward until the end of the first week in July. We are not surprised therefore that our mariners encountered such adverse conditions and their courage in pushing their vessel into the heavy ice at the entrance to Hudson's Strait deserved a better outcome. That the promoters of the voyage were pleased with the management of the expedition is shown by an item of news which appeared, on Nov. 29th, in the same journal from which I have already quoted: "Several of the principal merchants and gentlemen of this city who, with other merchants and gentlemen of North America, subscribed to fitting

[4] A kind of vessel then in use resembling a brig.

out Captain Swaine in the Schooner *Argo,* on the discovery of a North-west Passage, met at Bull's Head, in this city, on the 23rd inst. and expressed a general satisfaction with Captain Swaine's proceedings during his voyage, tho' he could not accomplish his purpose, and unanimously voted him a very handsome present."

So great was the interest aroused by this venture, that a second voyage of exploration with the same objects in view was dispatched the following year under the same leadership. Referring to this later expedition Jeffery says "The next year a second attempt was made as to a Passage; but three of the people who went beyond the place appointed by their orders, and inadvertently to look for a mine, samples of which had been carried home the year before . . . were killed by the Eskimaux and the boat taken from them. After which accident, with some disagreeable circumstances consequent thereon amongst the schooner's company, and after an experiment made of their disinclination to proceed on any further discovery, it was thought most prudent to return."

The return of this second expedition is chronicled in *The Pennsylvania Journal* and *Weekly Advertiser* for October 24, 1754. Soon after his return from this second voyage, Capt. Swaine turned over to the Library Company of Philadelphia, as a present from the North-west Company a number of costumes, utensils and "curiosities" illustrative of the life of the Eskimaux of the Labrador coast. Like the memory of the voyage itself, these ethnological objects have disappeared.

While painstaking local historians such as Watson in his "Annals[5] and Scarf and Wescott in their History of Philadelphia[6] make brief references to Capt. Swaine's voyage, the writer deems the story of what was probably the first American Arctic expedition worthy of preservation in more extended form both as a creditable incident in the early history of Philadelphia and as a modest contribution to the annals of Arctic achievement in general."[7]

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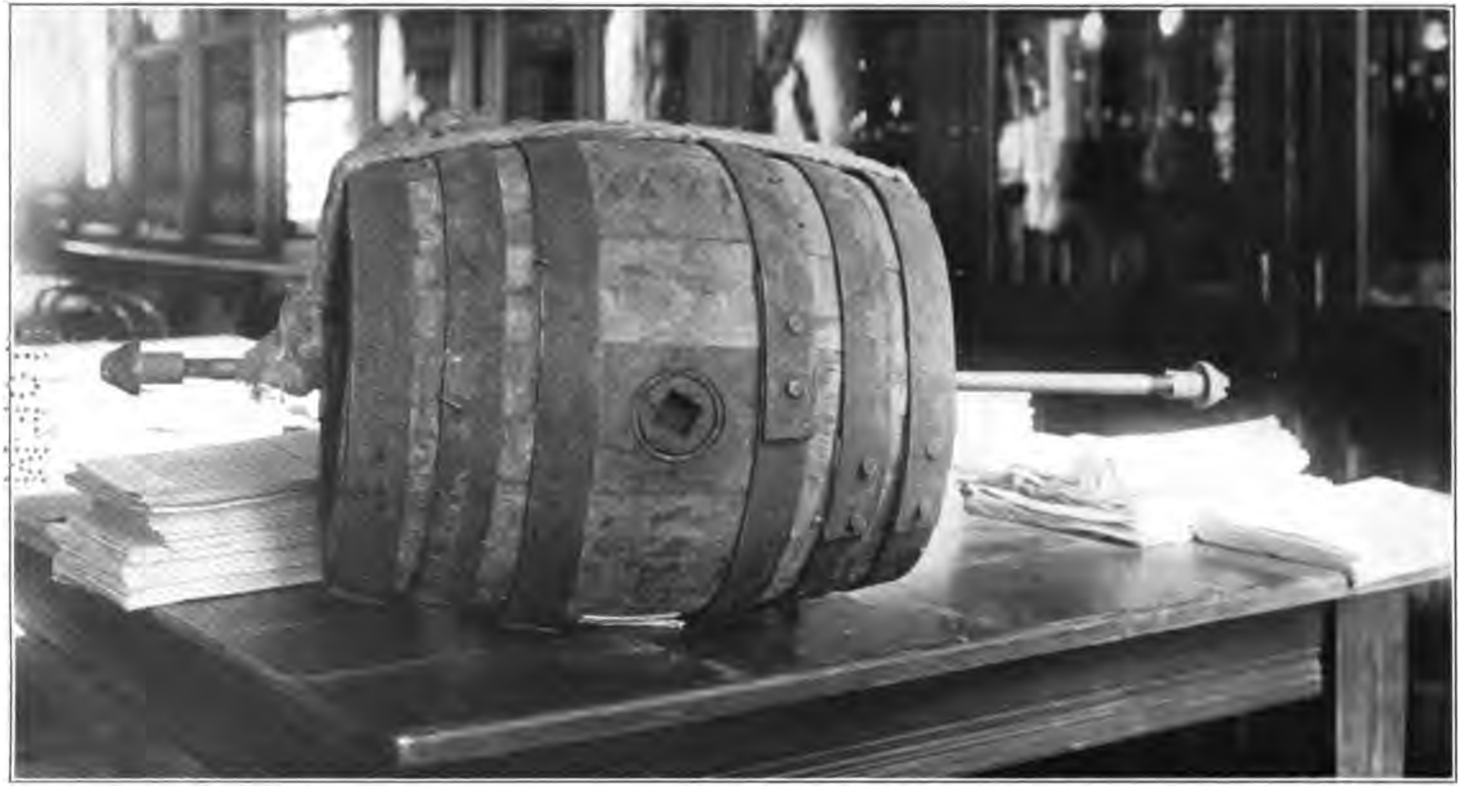
[5] Watson's "Annals of Philadelphia," Vol. II, p. 495.

[6] Vol. I, p. 246.

[7] Subsequent to the completion of this paper, the writer's attention was called to an interesting article relating to the same subject, by Mr. Edwin Swift Balch which appeared in *The Pennsylvania Magazine of History and Biography,* Vol. XXXI, No. 124, which was printed in June, 1908.



The above photograph represents the drift cask which has been returned to the Society, by the courtesy of Captain Roald Amundsen, of Christiania. This cask (No. 26) was placed adrift in the Arctic Sea off Cape Bathurst, British North America, on July 24, 1900, by Captain R. J. Cumiskey of the steam whaler *Narwhal*, and was recovered on Soro Island, south of the North Cape of Norway, on November 3, 1908. The enclosed message paper was in a good state of preservation, but in the long drift (estimated at 2,400 miles) the pointed wooden ends attached to the cask have disappeared, thus exposing the brass rod which held these ends in place. In the photograph the brass rod is shown fastened in place by a heavy cord, the heads of the cask having been broken in to secure the enclosed message.

A general account of the drift cask experiment, with diagrams of the casks and a reproduction of the printed sheet of instructions, appeared in the BULLETIN, Vol. IV, No. 2, January, 1906.

ANTARCTIC EXPLORATION—A RESOLUTION.

At the stated meeting of the Society on May 5, 1909, the following resolution was presented and unanimously adopted. In accordance with the second part of the resolution the President appointed the undersigned presenters of the resolution to be a committee representing the Society.

WHEREAS: The United States in former years did much to increase our knowledge of the Antarctic region, by means of the expedition of Lieut. Charles Wilkes, U. S. N., and the voyages of American whalers and

WHEREAS: There has been a great revival of interest in recent years in the south polar regions resulting in the despatching of scientific expeditions to explore portions of this area by England, Belgium, Sweden, Germany and France and

WHEREAS: Large areas in the far South still remain unexplored and many branches of science would be benefitted by the sending of an American expedition to the far South, having for its object the verification of Wilkes' discoveries and the collection of scientific data relating to the regions visited, Therefore

Resolved, That the Geographical Society of Philadelphia respectfully urges the federal government to consider the desirability of appropriating funds for the purpose of fitting out a suitable vessel, under the direction of the Secretary of the Navy, to undertake such exploration, and that the President of this Society is hereby authorized to appoint a committee of three members to represent this Society in this connection.

(Signed) EDWIN SWIFT BALCH,
HENRY G. BRYANT,
GEO. W. MELVILLE, U. S. N.

GEOGRAPHICAL NEWS AND NOTES

The *Geographical Journal* (London, March, 1909) contains an interesting discussion of climatic changes in South America by Professor Bowman, leader of the Yale South American Expedition in 1907. The article presents three sets of observations: first, those recorded by Darwin in regard to altered conditions of habitability in Chile; second, the observations of Moreno, which led him to conclude that there had been marked changes in northwestern Argentine; and finally, the data gathered by the author himself in the region east of Iquique. The correlation of the three sets of observations, obtained independently in different localities, with the evidences supporting the theories of great secular changes, is a valuable contribution to the literature of this important subject.

The first detailed account of Dr. Sven Hedin's latest explorations in Tibet, during 1906–1908, appears in the *Geographic Journal* (April). Among the many results of his work one of the most interesting perhaps is found in the fact that Tibet instead of being a vast plateau is really a region crossed by a series of mountain ranges, which are fast being reduced by the strong forces of weathering and erosion encountered at such high altitudes. To quote his own description: "The whole of Tibet is like a sea, the gigantic waves of which have been changed into stone at the moment of their worst fury. . . . After a certain interval one comes to a mountain wave much higher than the neighbors . . . the ranges are situated much closer in the west than in the east. They diverge from the enormous mountain knot of the Pamirs, and the distance between them becomes greater and greater to the east."

The plans for his North Polar expedition, as announced by Captain Roald Amundsen, do not, it is interesting to note, include any avowed intention of special efforts to reach the pole itself. The plan as outlined is as follows: With the *Fram* (Nansen's old vessel) equipped for seven years, he expects to leave Norway early in 1910, going to San Francisco, via Cape Horn, to take on coal and provisions. From there the course will be shaped to reach Point Barrow in July or August. Then the vessel will be driven as far as possible into the drift ice toward the north, preparatory to a drift across the polar seas, lasting probably four or five years. The feasibility of this plan has been suggested by the voyages of the drift casks, in the experiment undertaken by Mr. Henry G. Bryant and Rear Admiral George W. Melville, of this Society. It is one of these casks, only recently recovered, which is shown in this issue of the BULLETIN.

During his drifting voyage Captain Amundsen proposes to carry on oceanographic observations, working on the assumption that the most valuable returns from Arctic exploration are to be found in investigations of the polar ocean basins. In this belief he will receive the hearty support and commendation of the great body of geographers.

Colonel Gorgas's last official report (1908) on the Panama Canal shows a continuation of the same marked improvement of health conditions which have appeared in the two preceding years. The following figures suggest the extent to which modern sanitation has been effective in controlling tropical diseases and death rates.

Year.	Employes of Canal Commission.	Death Rate Per 1000.	Population of Canal Zone.	Death Rate Per 1000.	Cases of Malaria per 1000 Employes.
1907	39,343	28.77	102,133	33.63	424
1908	43,890	13.01	120,097	24.83	282

The death rate from disease among the white employes of the Commission was only 3.84 per 1,000 persons.

The *Bulletin of the American Geographical Society* (May) contains the first instalment of a discussion by Professor Percival Lowell on the tree zones of the plateau of the San Francisco peaks in Arizona. In brief his results are summarized in the recognition of five zones, determined largely by altitude, and ranging upward from 5,500 feet to 12,610 feet above sea level. He names the zones as follows: the desert zone, piñon zone, pine zone, fir zone, spruce zone, timber line zone, and the Alpine zones, the names being determined by the characteristic species of tree in each belt.

ACTIVITIES OF THE SOCIETY

AWARD OF THE ELISHA KENT KANE MEDAL

At the stated meeting, May 5, 1909, the Elisha Kent Kane medal was awarded by vote of the Society to Dr. Sven Hedin, in recognition of his valuable contributions on the geography of the little-known portions of Asia. His recent explorations, extending over nearly three years, 1906–1908, have led to the gathering of much new data concerning the Tibetan region, as a result of which the old ideas of that section must be radically modified, and parts of the map heretofore rather uncertain can now be filled in with greater accuracy and detail.

In carrying on these explorations it was necessary for Dr. Hedin to overcome many obstacles and brave many dangers. For his results he is entitled to unstinted praise by the scientific world.

At the annual election, the following committees were elected and appointed for the year 1909–1910:

Executive Committee—Henry G. Bryant, Chairman; William Libbey, D.Sc., Samuel F. Houston, Dr. Paul J. Sartain, Dr. Theodore Le Boutillier.

Finance Committee—Samuel F. Houston, chairman; Clarkson Clothier, Alba B. Johnson.

Library Committee—William Libbey, D.Sc., chairman; Harold Peirce, F. Norman Dixon.

Excursion Committee—Miss Rachael P. Barker, chairman; John W. Harshberger, Ph.D., J. E. Burnett Buckenham, Miss Mary S. Holmes, Miss E. E. Massey.

Entertainment Committee—Harold Peirce, chairman; Clarkson Clothier, Francis Fisher Kane, Mrs. Charles Roberts, Miss Rachael P. Barker, Miss Mary M. Vaux.

Publication Committee—Professor Emory R. Johnson, chairman; Walter Sheldon Tower, Ph.D., Henry Skinner, Ph.D.

Membership Committee—Clarkson Clothier, chairman; Professor Emory R. Johnson, Francis Fisher Kane.

Reception Committee—Mrs. Charles Roberts, chairman; Mrs. Theodore Le Boutillier, Mrs. James A. Develin, Mrs. P. F. Rothermel, Jr., Mrs. William Simpson, Jr.

RECENT ACCESSIONS TO THE LIBRARY OF THE SOCIETY

AMERICA, NORTH AND CENTRAL

CUBA .... OLMSTED AND GANNETT

Cuba. Populatiin, History and Resources, 1907. Compiled by Victor H. Olmsted and Henry Gannett. Washington, Bureau of the Census, 1909. Illustrations. *Presented by the Bureau of the Census.*

NORTH AMERICA—GEOLOGY .... WEEKS AND NICKLES

Bibliography of North American Geology for 1906–1907. By F. B. Weeks and J. M. Nickles. (U. S. Geol. Surv. Bull. 372.) Washington: 1908.

NORTH AMERICA—WESTERN .... OSBORN

Cenozoic Mammal Horizons of Western North America. By Henry F. Osborn. With faunal lists of the Tentiary Mammalia of the West by William D. Matthew. (U. S. Geol. Surv. Bull. 361.) Washington: 1909.

TROPICAL AMERICA .... MOORE

With Speaker Cannon through the Tropics. By J. Hampton Moore. Philadelphia: The Book Print, 1907. Illustrations. *Presented by the Author.*

UNITED STATES .... BAEDEKER

United States. With Excursions to Mexico, Cuba, Porto Rico and Alaska. By Karl Baedeker. Leipzig: Karl Baedeker, 1909. Maps and Plans. *Presented by the Publisher. To be reviewed.*

UNITED STATES—CALIFORNIA .... MENDENHALL

Ground Waters of the Indio Region, Cal. With a sketch of the Colorado Desert. By Walter C. Mendenhall. (U. S. Geol. Surv. Water Supply Paper 225.) Washington: 1909.

UNITED STATES—COLORADO .... SPURR AND GARREY

Economic Geology of the Georgetown Quadrangle (together with the Empire District), Colorado. By Josiah E. Spurr and George W. Garrey. (U. S. Geol. Surv. Prof. Paper 63.) Washington: 1908.

UNITED STATES—COLORADO AND UTAH .... RICHARDSON

Reconnaissance of the Book Cliffs Coal Field between Grand River, Colo., and Sunnyside, Utah. By G. B. Richardson. (U. S. Geol. Surv. Bull. 371.) Washington: 1909.

UNITED STATES—MAINE .... BASTIN AND DAVIS

Peat Deposits of Maine. By Edson S. Bastin and Charles A. Davis. (U S. Geol. Surv. Bull. 376.) Washington: 1909.

UNITED STATES—MAINE ....CLAPP

Underground Waters of Southern Maine. By Frederick G. Clapp. (U. S. Geol. Surv. Water Supply Paper 223.) Washington: 1909.

UNITED STATES—MINERALS.

Mineral Resources of the United States, 1907. Pt. 1—Metallic Products. Pt. 2—Nonmetallic Products. Published by the U. S. Geological Survey, Department of the Interior. Washington: 1908.

UNITED STATES—MONTANA ....FISHER

Geology of the Great Falls Coal Field, Montana. By Cassius A. Fisher. (U. S. Geol. Surv. Bull. 356.) Washington: 1909.

UNITED STATES—MONTANA ....FISHER

Geology and Water Resources of the Great Falls Regions, Montana. By Cassius A. Fisher. (U. S. Geol. Surv. Water Supply Paper 221.) Washington: 1909.

UNITED STATES—NEW MEXICO ....GIRTY

The Guadalupian Fauna. By George H. Girty. (U. S. Geol. Surv. Prof. Paper 58.) Washington: 1908.

UNITED STATES—OREGON ....DALL

Contributions to the Tertiary Paleontology of the Pacific Coast. Pt. 1—The Miocene of Astoria and Coos Bay, Oregon. By William Healey Dall. (U. S. Geol. Surv. Prof. Paper 59.) Washington: 1909.

UNITED STATES—UTAH ....ATWOOD

Glaciation of the Uinta and Wasatch Mountains. By Wallace W. Atwood. (U. S. Geol. Surv. Prof. Paper 61.) Washington: 1909.

UNITED STATES—WYOMING ....DARTON AND SIEBENTHAL

Geology and Mineral Resources of the Laramie Basin, Wyoming. By N. H. Darton and C. E. Siebenthal. (U. S. Geol. Surv. Bull. 364.) Washington: 1909.

ASIA

CHINA ....DAVIES

Yun-nan. The Link between India and the Yangtze. By H. R. Davies. Cambridge: University Press, 1909. Illustrations and map. *Presented by G. P. Putnam's Sons. To be reviewed.*

PERSIA ....AUBIN

La Perse d'aujourd'hui. By Eugene Aubin. Paris: Armand Colin, 1908. Map. *Presented by the Publisher. To be reviewed.*

EUROPE

ITALY—VESUVIUS ....JOHNSTON-LAVIS

The Eruption of Vesuvius in April, 1906. By H. Johnston-Lavis. (Scientific Transactions—Royal Dublin Society, Vol. 9, no. 8.) *Presented by the Author.*

SWEDEN.

Svenska Turistforeningens Arsskrift 1909. Published and Presented by the Swedish Touring Club. Stockholm: 1909.

PROCEEDINGS, REPORTS, ETC.

Atlantic Deeper Waterways Conference. Held at Philadelphia, Nov. 18, 19, 20, 1907. Report of Proceedings. Compiled and edited by Addison B. Burke. Philadelphia: The Book Print, 1908. *Presented by J. Hampton Moore.*

The Atlantic Deeper Waterways Association. First Annual Convention held at Baltimore, Nov. 17, 18, 19, 1908. Report of Proceedings. Compiled and edited by Addison B. Burk. Philadelphia: The Book Print, 1909. *Presented by J. Hampton Moore.*

Conference of the Governors of the United States in the White House, Washington, D. C., May 13–15, 1908. Report of Proceedings.

MISCELLANEOUS

BELDEN AND OTHERS

Washing and Coking Tests of Coal at the Fuel Testing Plant, Denver, Colo., July 1, 1907, to June 30, 1908. (U. S. Geol. Surv. Bull. 368.) Washington: 1909. By A. W. Belden and others.

BURROWS

Results of Purchasing Coal under Government Specifications. By John Shober Burrows. (U. S. Geol. Surv. Bull. 378.) Washington: 1909.

PHELPS

The Pollution of Streams by Sulphite Pulp Waste. By Earle Bernard Phelps. (U. S. Geol. Surv. Water Supply Paper 226.) Washington: 1909.

RAY AND KREISINGER

The Significance of Drafts in Steam Boiler Practice. By Walter T. Ray and Henry Kreisinger. (U. S. Geol. Surv. Bull. 367.) Washington: 1909.

SALISBURY AND ATWOOD

The Interpretation of Topographic Maps. By Rollin D. Salisbury and Wallace W. Atwood. (U. S. Geol. Surv. Prof. Paper 60.) Washington: 1908.

MAPS

Pilot Charts of the North Atlantic Ocean for April and May, 1909.

Pilot Charts of the North Pacific Ocean for April and May, 1909.

Japan—Iki Sheet. Published by the Geological Survey of Japan, 1908.

Plans and Sections of the following Gold Districts of Nova Scotia: Cochran Hill, Oldham, Montague, Forest Hill, Mount Uniacke, and Gold River. Published by the Geological Survey of Canada, 1898–1904. *Presented by the Geological Survey of Canada.*

THE HIGHLAND DWELLER OF BOLIVIA: AN ANTHROPOGEOGRAPHIC INTERPRETATION.

ISAIAH BOWMAN,

Assistant Professor of Geography, Yale University.

The most enthusiastic and interesting work in geography has undoubtedly been done in relation to the more primitive folk of the earth who are living out on the margins of the habitable lands. There we find man fighting the elemental forces of nature with the chances more evenly divided between danger and security. Interest centers now about that group of people which by superior intelligence or a wider margin of safety finally brings under at least partial control forces that at one time threatened to overwhelm it; now about that group which is going under in the struggle with pitiless nature, as is the case with the dying people of Tauu in the south Pacific.[1] The struggle is never the same everywhere, either in kind or intensity. But whether it be a struggle with aridity, or with cold, or with a sterile soil, it is everywhere a real struggle full of the elements of human tragedy. Scarcely a year goes by in these marginal lands that nature does not take merciless toll from her simple children. The heavier snows and severer frosts of a single year in the northland of North America drive in the Eskimo outposts on the edge of the polar tract and leave deserted a wide stretch of country in which man has found life so hard that even escape to a more favorable situation within the border of safer lands has not always been possible. In these seasons of greater cold grim death stalks everywhere and not even the wild animals escape. Whole villages are overwhelmed, or only starving remnants are left as the nucleus of a new group. So, too, in the desert, the cyclic return of more severe droughts drives back the edge of habitation. The poor range becomes poorer and then impossible, the burden of animal subsistence is thrown upon the already burdened oases, and sometimes, as at Copiapó, Chile, in the early part of the nineteenth century, the whole population is obliged to emigrate to the adjacent better watered areas.[2]

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[1] "The Dying People of Tauu," by W. Churchill, *Bull. Am. Geog. Soc.*, vol. 41, No. 2, Feb., 1909, pp. 86-92.

It requires sympathetic study to realize how thoroughly a folk may be dominated by the vicissitudes of climate and soil in the tracts with but a narrow margin of safety. The wide distribution of man today, an appreciation of the "Oekumene" of Ratzel,[3] the occurrence of artifacts in many regions long since abandoned by man—all these, and more, give one an impression of how far the great human migrations have carried the race. They lead one to an easy belief in the readiness of men to retreat before unfavorable conditions, or to shirk a hard environment. The state of mind to which this leads must be corrected by a knowledge of the tragic end, often of whole communities, as Algarrobal, in northern Chile; Tauu, in the south Pacific; and the scores of other localities in which man neither flees his environment nor yields save to a final overwhelming catastrophe. Men are rooted to the soil upon which they were born to a much greater degree than is generally believed. Not all can live in the most attractive places; a large part of the human race must struggle with its environment and bear the marks of the struggle; an appreciable part regards its home land, though a desert, as the part most favored by providence, and succumbs, if need be, rather than migrate to an unfamiliar land.

One must have this fundamental sympathy with mankind to understand a given distribution or to see in the humble activities of primitive folk not always stupidity, nor ignorance of the better places of the earth, but a response to the earth as the mother of men who are attached to the home places. This is what leads an educated and traveled Venezuelan or Guatemalan to remain in his unfortunate country, though this means enduring the indignities of a tyrannical ruler; or an Aymara Indian to love his bleak mountain side though enchanting valleys within sight of his home smile a welcome which seems all but irresistible. In the following interpretation of the highland dweller of Bolivia an attempt is made to estimate the forces that control distribution and activity and the degree to which and the way in which man is affected by the natural region in which he dwells. The climate and the general physi-

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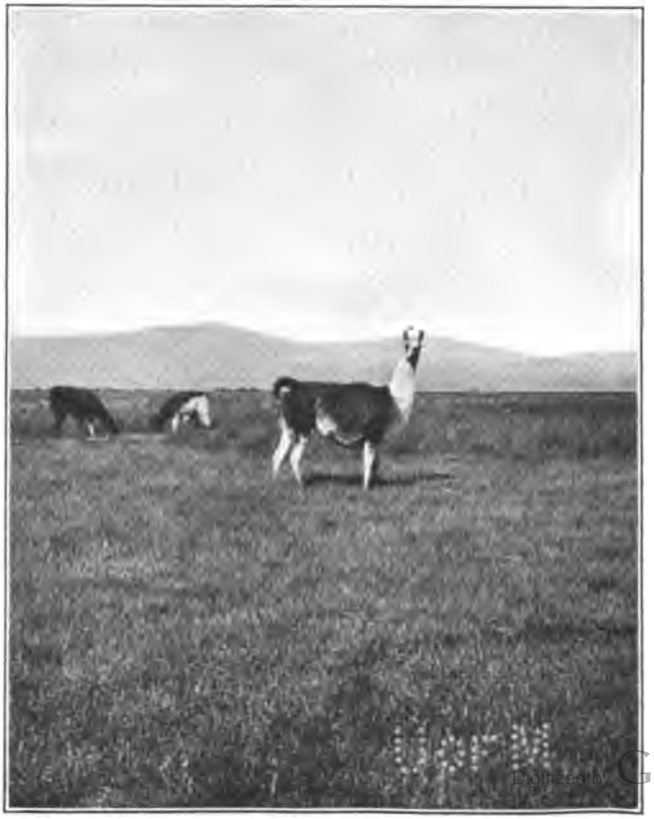
[2] "The Voyage of the Beagle," by Charles Darwin.

[3] Anthropogeographie, vol. 2, chaps. 1 and 2.

Flock of Llamas and Shepherdess Near Suisigua, Bolivia. Tola bushes are in the foreground. The horizontal line on the slope in the middle distance is an irrigation canal which waters the gardens of the town.



Specimen of the Better Kind of Llama at Calama, Chile

ography are considered in other chapters. The present one is devoted almost exclusively to the human geography of Bolivia, after a preliminary word as to the loftiness of the Bolivian upland.

The most important quality of the Andine Cordillera viewed from the standpoint of human geography is its extraordinary and uniform height, throughout nearly its whole length and breadth. Snow-capped summits in the tropics are not so numerous as ever to cease to hold, even with further exploration, the interest of the geographic world. They are one of the novelties of travel in the torrid zone. It is impossible not to be moved to admiration on catching sight of magnificent Chimborazo, snow-capped in clear sight of a steaming tropical plain. The height of the Andine plateaus is so great—11,000–16,000 feet—and their high altitudes are so uniform that high altitude is far more important from the view point of the people who dwell there than isolated though greater heights like Chimborazo or even the probable culminating peak of the Western hemisphere, Aconcaqua, 22,802 feet.[4]

For that part of a population group which acts as carrier to the rest of the group the practical height of a mountain or plateau is the height of its passes. Applied to the Andes, this principle receives startling illustration. The Sillilica pass between Oruro and Iquique is nearly 16,000 feet high, a high notch in a volcanic range. The pass between La Paz and Arica crossed almost daily by the mail coach or by caravans, is 15,000 feet high and all along the western front of the eastern plateau one rises from 12,000–15,000 feet in order to descend finally to the river plains east of the Andes. Railways do not climb to high places for effect, they are built into the very lowest of the high altitudes compatible with their chief purpose of getting to large towns or mining sites. Yet the line from Antofagasta to Oruro climbs, perforce, to 13,625 feet; the one from Mollendo to La Paz reaches 14,666 feet; and the highest railway in the world, to the mines at Cerro de Pasco, attains 15,655 feet. The railway from Viachi to Oruro, which connects that city with La Paz, is built through basins and valleys, and to a less extent on flat-topped plateaus, and yet the lowest altitude on the line is more than 11,000 feet and at El Cumbre, near La Paz, the branch line connecting it with that city is above 13,000 feet. La Paz itself lies nearly 1,500 feet deep in an exceptional depression, yet it is 11,500 feet above the sea, at the head of the La Paz valley.

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[4] According to the latest and best determination by Fr. Schrader. *Comptes Rendus, Acad. Sciences,* Paris, 29 Juillet, 1907.

Turning now more directly to the human geography of the highlands of Bolivia we find, first of all, that the great Andine Cordillera of mountains and plateaus is a far more serious barrier, even to the modern railroad[5] (which exists rather by reason of the mines it serves than for the traffic of the towns along its course), than it is to the Indian and his llama. In the case of the railroad the coast is the great objective point. No railroad line was ever built in this part of South America which both began and ended at interior towns. The important connecting link between Viachi and Oruro that unites La Paz with the latter city and that might seem to constitute an exception to this rule was built less for the traffic between these two of Bolivia's four largest cities than as serving to equalize the traffic of the seacoast railroads from Mollendo to La Paz, and Antofagasta to Oruro. These two lines have been not only without rivals but also have enjoyed the additional advantage of separate termini, 150 miles apart, so that part shipment over more than one line was not possible and therefore competition was not possible.

With the coast as the objective of the interior railroad, vast unproductive mountain and plateau spaces must be overcome at great expense, not only for construction but for maintenance. Ties for existing roads were brought from Oregon and Australia; rails and rolling stock from England; fuel is now imported from Wales. These are not the only disadvantages. They are only the last in a series which begins with the long ocean voyage by way of the Straits of Magellan or the shorter voyage with expensive transshipment at Panama, voyages absolutely required to deliver the tin, silver and copper of Bolivia's mines to the manufacturing plants of the north temperate zone.

To the Indian traveler or tradesman, on the other hand, the journeys are chiefly from town to town in service of local traffic and even when his way is, like the railroad, over difficult mountain routes, it is to find his business completed by reaching a land station. Of course such is not the case where the llama is an auxiliary to the railroad, but such a relation to the railroad is not important

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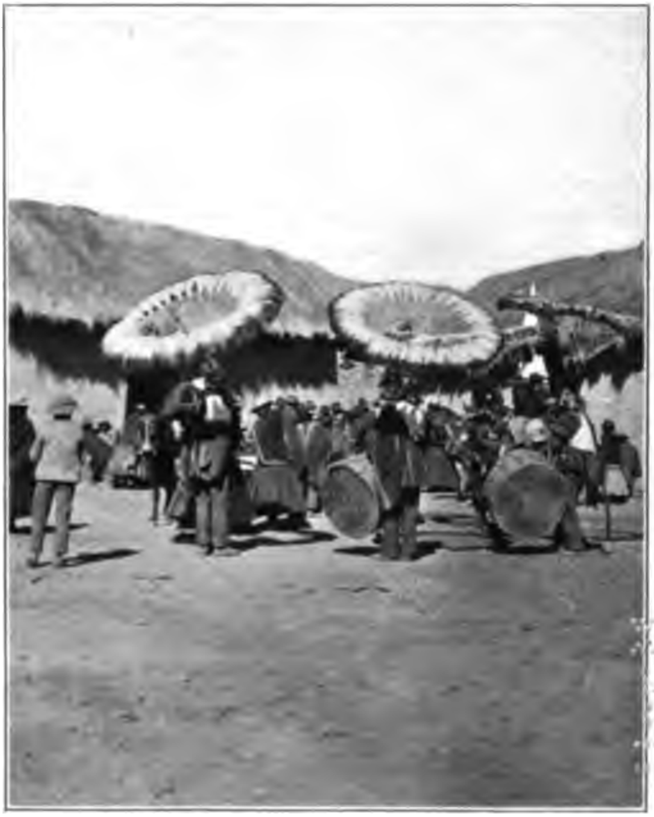
[5] "Trade Routes in the Economic Geography of Bolivia," by Isaiah Bowman, *Bull. Am. Geog. Soc.*, vol. 42, Nos. 1, 2, 3, 1910.



DANCING CEREMONIAL DURING A FIESTA AT CHALLAPATA, BOLIVIA. The feast occurs at the end of the harvest. The plumed umbrellas are carefully kept for this occasion. The ceremonial includes praise to the Deity for the harvests, prayers for rain and food, songs and dances, marches, and the consumption of much "chicha", the national beverage. The photograph was taken after the principal ceremonies had been performed when the participants were too much affected by chicha to oppose the act, or even to observe it.

enough in the aggregate to constitute a marked exception. Furthermore, the maintenance of the llama is not a burden to the owner, for the beast is driven but fifteen miles a day, or thereabouts, and thus enjoys a certain leisure wherein to wander more or less idly from bush to bush and forage for subsistence. Time is of no consideration to the driver or his projects and his profits may consequently total a small figure and yet be ample, considering the outlay.

It must therefore be carefully designated when the mountainous *barrier* is introduced into an exposition whether it is in relation to that local traffic which is measurably independent of the railroad (unless on the route to a mine) or whether it is in relation to modern steam transportation. Looked at from the former standpoint no real barrier exists. To these mountain and plateau peoples, numerous as they are, and well advanced in the art of abstracting a living from an inhospitable and lofty land, the Cordillera is not a barrier but a home. Their corrals may be found up on the mountain sides as high as 16,000 feet and they frequently wander to even greater elevations in search of moss for fuel, or pasturage for their nomadic flocks and herds (Fig. 1). For them the crossing of a 16,000-foot pass is therefore only following an accustomed mountain road and not climbing to a high elevation. Not that they are free from the effects of these extreme elevations, but they are accustomed to the effects and in a measure mitigate them by the incessant use of the coca leaf. In spite of untold generations of existence at these high altitudes, their systems have not become wholly adjusted to them. Physicians at La Paz and Oruro assure us that some form of heart disease is common, if not general, among the plateau Indians; and pulmonary diseases due to the cold nights and the bitter winds of the exposed heights and passes, as well as to the ignorance and intemperate habits of the Indians themselves, are the most common causes of death.[6] While these hard physical conditions would exclude occupation of the mountain tracts by the

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[6] Climatological statistics for La Paz, Bolivia (elev. 11,900 feet) for a period of ten years have been recently reported by V. E. Marchant. Estudio sobre la climatologia de La Paz, La Paz, pp. 48. The mean annual temperature is 50.4°F. The absolute extremes were 75.2° (January, 1903) and 26.6°F. (June, 1901). The rainfall was 15.88 inches in 1901 and 32.84 inches in 1903. Switzerland's monthly means are 26° for January, and 68° for July, ("The International Geography," p. 259) or nearly the values for the extremes of La Paz.

Indian of the plains, the mountain Indian, accustomed to them from infancy, takes them as a matter of course and roams the mountain sides and the valleys without fear or even with very little thought of cold.

In the manner in which the Cordillera Indian occupies the land there is offered a strong contrast to the condition in the desert of Tarapacá in northern Chile. There it has been shown[7] that the extreme degree of rainlessness precludes pastoral activities. No nomad herds may there wander about and hope to find even a meagre supply of food. The downright nakedness of the vast areas outside a few scattered oases makes grazing impossible. Cattle and sheep are maintained only at the irrigated oases and the population is strictly sedentary. To travel or to barter means first to conquer sheer waste space which will not even support the pack animals that carry the goods. The consequent effects, in emphasizing the isolation of separate groups of oases dwellers are strongly marked.

The plateau and mountain-dwelling Indian is more fortunate in this respect. He lives in the very highland which acts as a barrier to the rain-laden winds and not in the desert to leeward of the barrier. His land is likewise arid, even desert, but its aridity is less intense. Thunderstorm rains are common at the change of the seasons, as when spring begins; and his farm is nearer the source of the streams—the winter snows—than is the farm of the oasis dweller of Tarapacá. He may therefore irrigate his already naturally better watered land more bountifully. His most important advantage however lies in the pasturage which the inter-oases tracts afford. The light showers are sufficient to maintain some sparse and scattered vegetation. Bunch grass occurs here and there and the young edible shoots of tola bushes, cacti, etc., are also available. In addition lichens and mosses of several edible varieties form a food resource for stock of no inconsiderable amount; and these grow right up to the snow line. Of course the scattered tufts of grasses and the individual spears of grass that spring up after a shower and tinge the hillsides green are the chief forage resource.

In consequence of the widespread pasturage, flocks of llamas may be grazed upon well-nigh every agriculturally unoccupied tract

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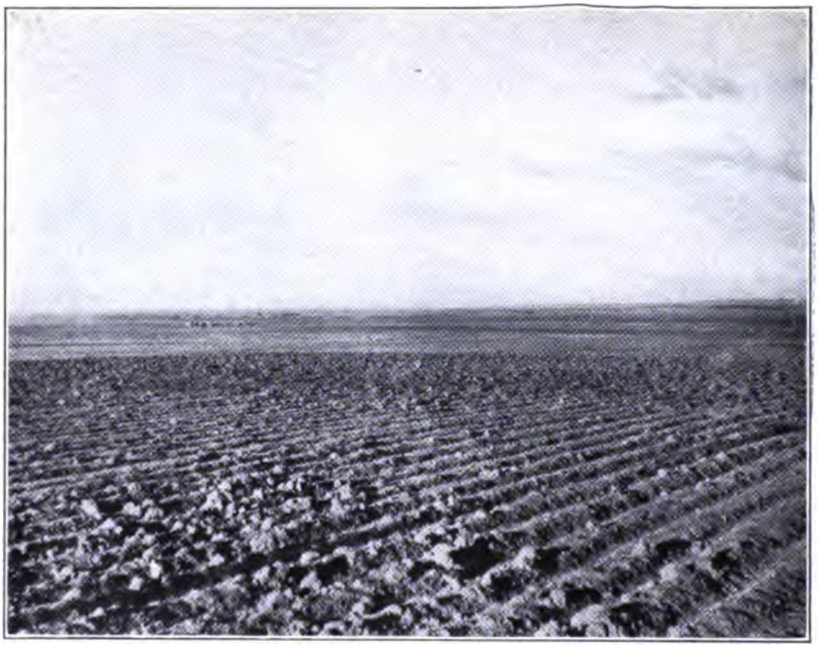
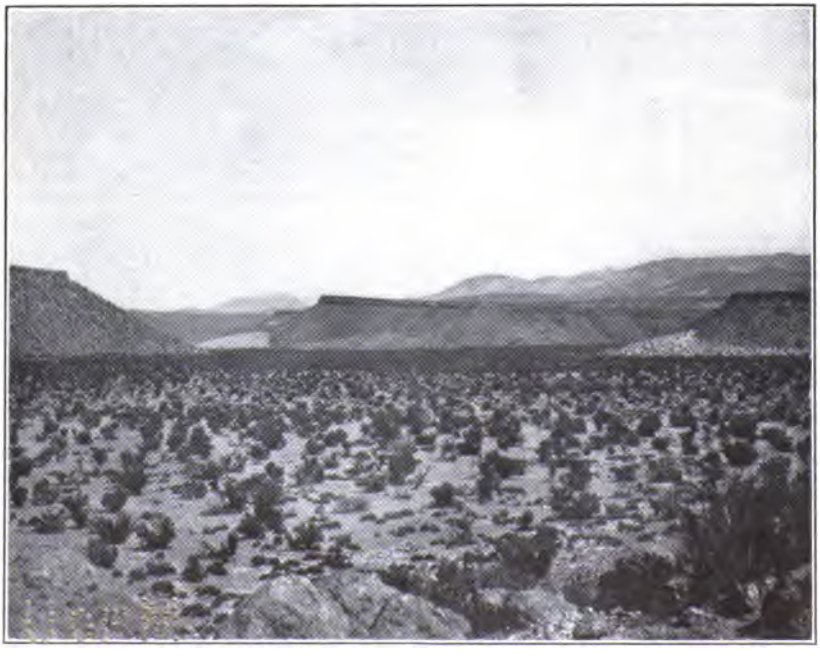
[7] "Regional Population Groups of Aatacama," by Isaiah Bowman, *Bull. Am. Geog. Soc.*, vol. 41, Nos. 3 and 4, 1909.



General View of the Great "Alti-plano" or High Plateau of Bolivia. The view is taken looking south of the railroad station at Viachi just outside of La Paz. The Cordillera Real show faintly in the background. The plateau is both cultivated and grazed. The rains are sufficient to allow a certain amount of agriculture without irrigation.



Typical Desert Mountain Flora on the Western Border of Bolivia. The locality is west of Suisigua where only the smallest villages are found. A wide salar separates these folk from the rest of Bolivia and the Maritime Andes separate them from the oases of Atacama in Chile.

that exists outside the salars and snow fields. To be sure, thousands of square miles in Bolivia, and on the mountainous frontier between Bolivia and Chile, are undergrazed or wholly vacant, but overgrazing is a fact near the centers of densest population; land and grazing rights are there a matter of livelier concern. Likewise, the tracts between closely adjacent springs are well grazed as a rule but there are no artificial devices even of the simplest sort for procuring water for flocks where pasturage but not drinking water occurs naturally; and that grazing as an industry is on the whole underdeveloped in consequence is apparent even to the casual observer. Nevertheless, to one who has come directly from the coast desert to the Andine plateau and the mountains the significant facts appear to be not the underdevelopment of the grazing resource but the widespread occurrence and use of these mountain pastures as compared with their absence in the coast desert, and their distributional effect upon the inhabitants. Instead of the wholly sedentary population groups of the rainless coast desert there are here partially fixed groups whose time is divided between agriculture and grazing, while a distinct though small number of population units are wholly dependent upon grazing. These latter live in isolated sections among the mountains in huts of roughest construction and range widely with their flocks now in this direction, now in that, often spending several nights in succession in bleak corrals arranged at wide intervals on the periphery of the occupied tract.

As a rule therefore the mountain and plateau Indians are fundamentally agricultural as well as pastoral. The irrigated oases are relieved of the burden of animal subsistence but grazing is not generally the sole or even the chief-occupation. Further reasons for this are noteworthy. In the first place the products of the flocks, wool and meat, while indispensable, are also insufficient in themselves. Vegetable foods, grains, and the like, the products of the farms and gardens, are demanded. The actual working combination is one which by the natural development of centuries very closely resembles the ideal homestead unit in our arid West. There, as here, the farm is located near the water supply and is supplemented by the wide range behind it; either farm or range alone would be insufficient for the desired degree of comfort or prosperity. In this supplementing of the garden by the range, lies also the essential difference between the desert of Tarapacá and the plateau region. The second reason for the dominance of agriculture lies in the greater variety of foods it offers and the comparatively greater security and comfort the farmer enjoys in extracting a living. Finally, it may be said that farming and grazing may be combined where agriculture is the chief resource, while on the other hand it is not easily possible for a nomadic people, living chiefly from the products of the flock, to farm. The necessities of their flocks require constant movement and crops are without that protection from other wandering flocks and shepherds which the home nearby affords. Such agricultural foods as are consumed must be purchased from the farmers of the oases.

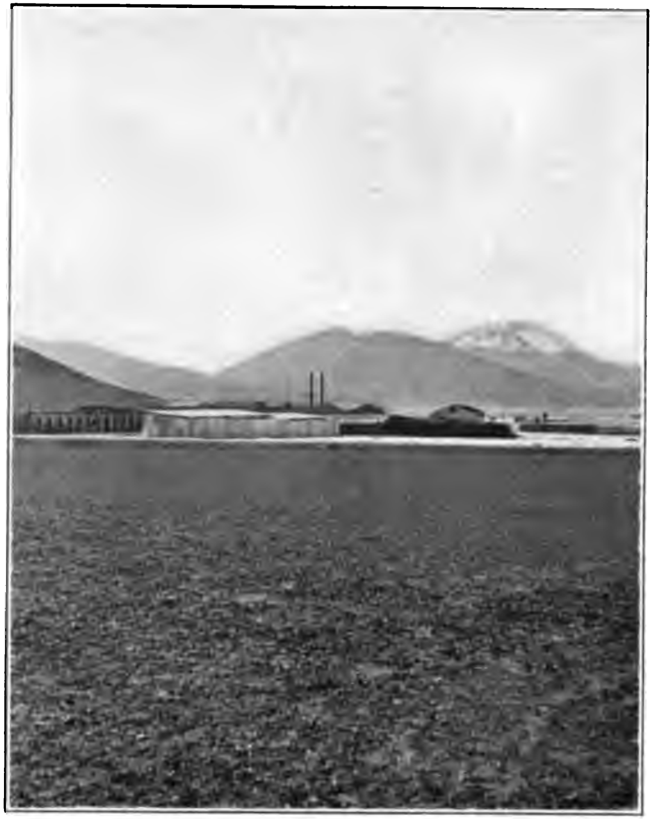
In consequence of these sources of food supply the population groups of the mountains and plateaus of Bolivia are widely scattered as to occupation. The coast desert dwellers are compact both as to occupation and as to dwelling; the highland dwellers are compact as to dwelling and dispersed as to occupation. The highland man is a nomadic traveler to the degree that flocks are a supplemental resource to his farm. He scans the whole country side for good pasturage, drives his flock for days through little known lofty valleys, and only returns when his supply of food becomes exhausted or there is herbage once more upon the over-grazed range near his habitation. He is a great traveler in consequence, and knows the mountain ways intimately. It is a constant marvel to one in the mountains to see to what altitudes the shepherd climbs and what out-of-the-way places he reaches. He is the characteristic element in the Andine scene—bleak slopes in some high valley, a widely scattered flock of llamas, a solitary shepherd whistling and clucking to his vagrant flock and industriously spinning the llama wool into yarn as he trots along, often without food save the leaves of the coca, and without water for a day or more at a time, far from any shelter, alone. He is an excellent guide, fearless and confident, with knowledge of every spring and trail and no special concern for ordinary altitudes below the snowline. The Indian guide we secured at Pica, Chile, on the coast desert only reluctantly consented to show us the trail across the Maritime Andes to Llica, Bolivia. He was afraid of bad Indians, but chiefly he feared the *sirroche* or mountain sickness and the possibility of snow, for it was in the winter season. He finally consented to guide us only as far as Lake Huasco at the foot of the volcanic range which constitutes a crest range upon the western plateau. Now all these would be unthinkable objections to the highland Indian who may actually be seen at times tramping barefoot or only in sandals over the light snowfall of the previous night. Likewise, the plains dweller, whether from the east of the Andes in the moist sections, or from the west, in the desert, finds the high altitude trying. On the other hand, the highland dweller, accustomed to the effects of high altitudes and partially adapted to them, gives them but little thought and jogs along all day at a quick pace up and down mountain sides with no apparent discomfort. Above the snowline he suffers as does the white man from mountain sickness in spite of the coca leaves which mitigate the effect of moderate elevations, and can only with great effort be induced to continue to ascend. His imagination peoples the higher tracts with evil spirits who, offended at his intrusion, drive him with sickness and pain out of their homes.

It was this fixed quality of the inhabitants and their entire dependence upon agricultural and grazing resources that undoubtedly assisted in making their manipulation easier at the time of the Spanish conquests and since then in the development of parasitic relations of the conquering peoples to the conquered. They had no fertile but wild mountain valleys to which to escape, these were already occupied; the loftiest situations could be and were temporarily occupied but a return had eventually to be made to the valleys; they had not forests in which to hide, no grass lands to roam, no remote islands for refuge. Their destiny must be worked out upon the soil. Whether conquering or conquered no modification could be developed which affected their sedentary character. No less direct were the effects of the high state to which agriculture had developed through irrigation. Interdependence was the keynote of the Inca civilization and the principle could not but be welcomed in a land where the beneficent effects of coöperative irrigation were so immediately apparent.

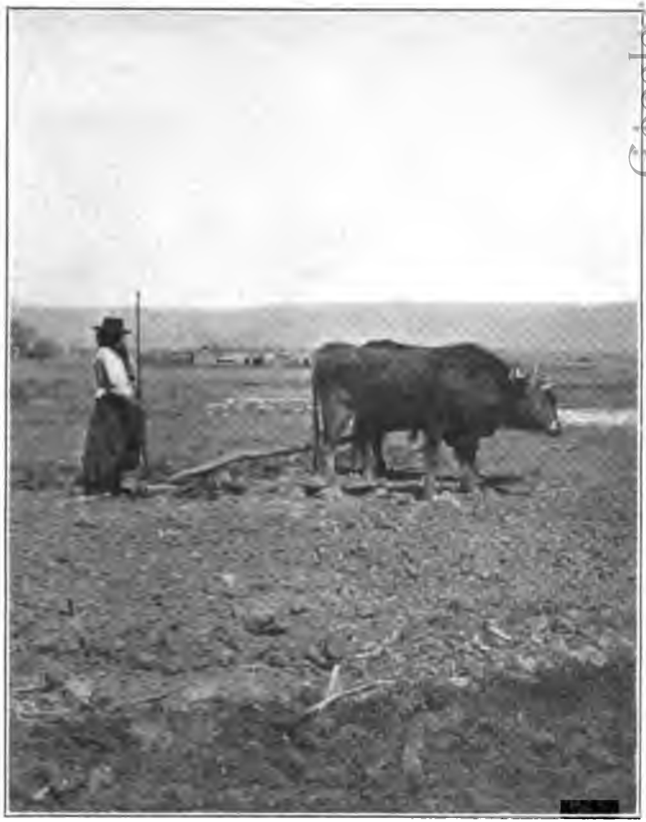
Between these highland peoples on the one hand and the plains peoples to east and west on the other there is commercial interchange of a definite sort. The highlands are well adapted for the growth of the potato, prepared or cured in various forms. There are at least a dozen natural varieties of potato and a still greater variety when ready for the market. Several varieties of small grains somewhat like millet are also produced here, and cheap llama and alpaca wool and flesh, besides firewood, moss, and vicuna skins and wool, the last-named being products of the chase. These are not produced or but scantily produced upon the plains and are supplied by the mountain dweller. In exchange for them the plains dweller of the desert offers the manufactured goods imported from the coast towns in certain quantities and the fruits both dried and fresh which grow below the limit of frost: oranges, figs, lemons, and the like, besides dozens of varieties of peppers and other more peculiar condiments. From Llica, Laqueca, Canquilla, and Suisigua, Bolivia, there are frequent caravans bringing coca leaves, firewood, wool, and millet down to Pica and towns nearby, a week's llama journey from the mountains, in exchange for the above articles and alcohol. The trails of this region are not guarded and smuggling in alcoholic beverages is therefore widely practised on account of the extremely heavy import tax which the Bolivian government imposes upon these commodities to effect their reduced consumption among the Indians.

The Indians of the plains east of the Andes and those of the lower valleys and slopes of the Andes themselves, have a third group of products. Their currency, so to speak, is the coca leaf, like the potato of the plateau dweller, or the alfalfa or the grain of the oases dweller in Tarapacá. Bananas, beans, peas, rice, chocolate and sugar are other products peculiar to their country. These are brought to the plateau sometimes by the plateau dweller but chiefly by the plains dweller for the llama of the plateau will not survive the effects of humid tropical heat, while the burro and mule of the plains are not fatally affected by moderately high altitudes. The tropical products once delivered to the plateau the plains Indian has no share in their further diffusion. It is the highland Indian who distributes them to all the consuming centers both upon the plateau and the desert to the west. By reason therefore of the great breadth and height of the plateau, and the adaptation which the beast of burden, the llama, as well as his driver, has developed to travel at high altitudes, together with the complementary nature of the products of the plateau and those of the plains on either side, the highland dweller is the middleman of the region.

It is readily appreciated how fortunate is the position of this highland area with respect to the maximum utilization of food resources. In this latitude the high plateau is not so high but that



Borax Works at Cebollar, Chile. These are on the border of the borax lake of Ascotan. They were abandoned during the war between Chile and Bolivia during the early eighties but have since been resumed.



Woman Plowing with Oxen and a Crooked Stick near Cliza, Bolivia. Farming in this Republic is still exceedingly primitive in many sections despite the cleverness displayed in the use of water for irrigation.

it is still cultivable and yields food not grown upon the plains. Were it exceedingly narrow a small population only could exist upon it. The oases dwellers on the west as well as the plains dwellers on the east would far exceed the highland population in numbers and there would not then be that stimulation to trade which the now more balanced populations enjoy. We have therefore the phenomenon of a lofty and broad *inhabited* upland, which, if narrow and sparsely inhabited, would not only not attract the adjacent peoples but would constitute by its loftiness, in the absence of trading folk, a very serious difficulty or possibly an obstruction to the people of the adjacent lands.

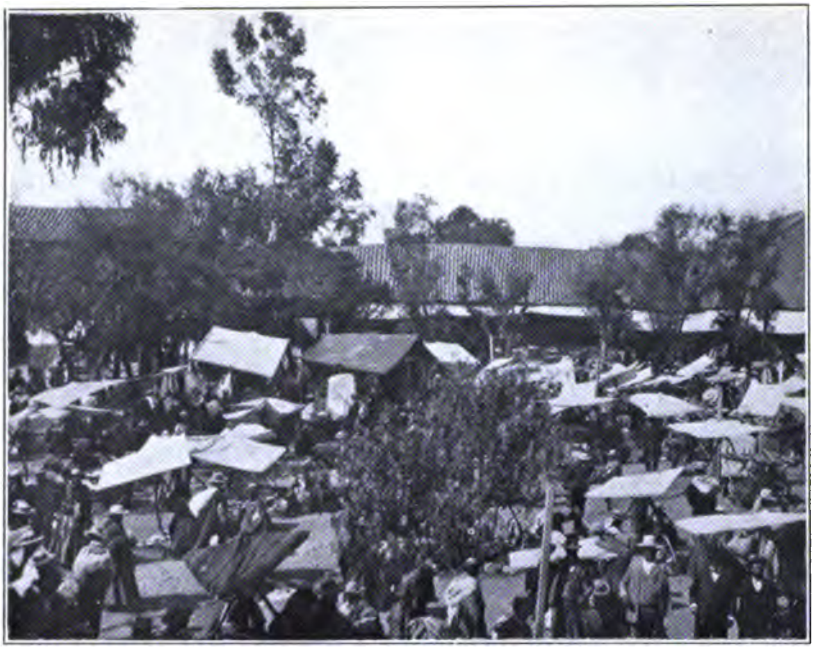
As at present organized the trade of the region is chiefly between the eastern plains and the plateau. Before the railroads were built, great numbers of caravans sought the coast for merchandise. While the coast and desert peoples of that day were far less numerous than either of the other units, they for the most part enjoyed the strategical advantage of communication with the sea and the possession of imported products. Now the railroads bring foreign goods to the very heart of the plateau at Oruro and La Paz, and the coast region, so far as caravan trade is concerned, is largely excluded from the circle of trade save for the relatively feeble interchange already noted.

The commercial relations of the highland people and those of the plains and the valleys in the eastern Andes are synthetically expressed in two systems of fairs of unusual interest. They are a clear index of the great differences between these two groups of peoples located so near each other and are exceptionally important not only by virtue of the large areas affected but also because of the minute and accurate reproductions they exhibit of the life and fortunes of the people who participate in them.

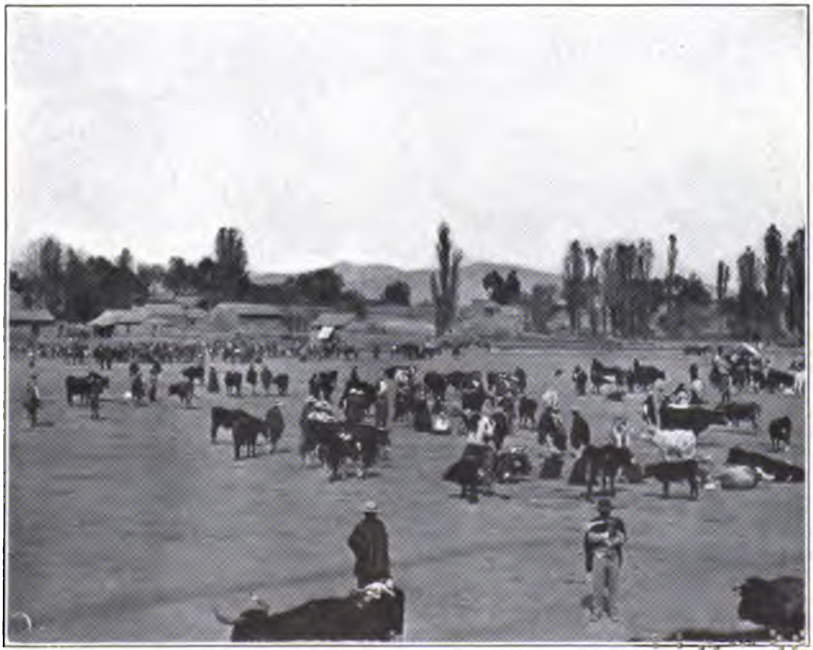
The first system is represented by the annual fair near Huari, Bolivia. This otherwise unimportant town is seventy miles south of Oruro, and is a station on the Oruro-Antofagasta railway. East of it are the long slopes of the western edge of the eastern plateau. The town itself is on the broad gentle slope of the low piedmont accumulation at the foot of the plateau scarp. Farther west is the flat white Salar de Uyuni and the great empty spaces of the central basin of Bolivia. The fair is held in the southern autumn just after the close of the harvest season and while there is still sufficient pasturage in the fields and ranges thereabouts to support the great droves of llamas, donkeys, and sheep which are congregated by the traders. These must be cared for and as no wholesale system of forage accumulation is practised by them the pastures are the chief resources. There is in addition a considerable quantity of both green and ripe but unthreshed barley brought by caravans from the fields in the vicinity of the fair. Huari itself is not a town of any importance beyond the fairs annually held there and was only selected to begin with because of its central location and the relatively abundant free pastures about it, the latter fact being in turn dependent upon the small size of the town. Were the trading to be attempted in a large town like Oruro or La Paz the cost of living would be so great to the visiting caravans that the profits would be quickly consumed and the barter system discouraged. As at present organized the traffic will bear little expense at the fair because of the bulkiness and therefore high cost of the products per unit distance required to be traversed to effect an exchange.

The Huari fair draws men and products from almost every section of northern Argentina, and southern and central Bolivia. They come over the trail from Tupiza, down from Oruro, Machacamarca, and Challapata, from Sucre and even from Santa Cruz beyond the edge of the eastern Andes. Argentine mules and donkeys are brought up in great droves, also leather goods of every sort, and exchanged for the products of the plateau—silver work, blankets, and frost-dried potatoes, very light, and easy to carry on the return journey. Many of the animals are sold outright to the mines for money. Chocolate finds it way thither from the eastern plains and very dirty and crude it is in its local market condition; rice and sugar are also brought from the plains, and coca leaf is in every caravan from the north, where it has been brought in from the eastern slopes of the Andes. The plain is alive over a great area with every sort of humanity and every sort of goods that the contributing sections produce or the seaport railroads supply.

For barbaric splendor of the trading variety it surpasses all but a few of the native trading pageants of the western hemisphere. It appears to one as a distinct echo of the old days of the Spanish fairs when goods from well-nigh every country in the world were foregathered at Panama, then taken south along the Pacific coast



The Central Plaza at Cliza, Bolivia, During the Progress of the Weekly Fair. Vegetables, meats, fruits, and cloth are displayed here beneath small booths made of squares of cotton cloth set upon a tripod of crooked sticks. These are shifted with the sun for the protection of the vender and his wares.



The Cattle Plaza, Cliza, Bolivia, during the Sunday fair held weekly throughout the year. This weekly fair has been established for 70 years. There are separate plazas for each staple article sold. The Cliza fair is one of the great trading pageants of South America.

and finally shipped overland to trading centers in Argentina and Bolivia. The habit of the fairs characterized by selective barter has persisted to this day owing to a restricted and more or less fluctuating currency and the lack of quick transportation, or any adequate regular transportation at all, for the equalization of the surplus products of these two contrasted regions. The trading done, the traders pack up their goods, and with their families, which often accompany them, return over long and difficult trails to their homes. It is as if large numbers of the population of Bolivia and northern Argentina went a-fairing with the picnic spirit as befits the commemoration of such stirring days as those of the colonial traders of Spain.

To understand the other sort of fair, the weekly fair, it is necessary to recall that within the eastern plateau are only a few valley basins where flat land of any extent is to be found. One is at Sucre, another at Cochabamba, and a third is practically conterminous with that at Cochabamba, the pampa of Cliza. These have made the large cities of Cochabamba and Sucre besides a notable group of lesser towns such as Cliza, Arani, Sacaba, Tarata, Punata, and many others. The full significance of the weekly fair is appreciated when one discovers within what short distances of each other two almost absolutely contrasted regions lie. One may see a group of Indians harvesting potatoes on the dry semi-arid plateau in a cold raw wind at 12,000 feet above sealevel and just east of the village of Cuchiconchi on the trail between Cochabamba and Inca corral. It is but a half hour's ride from this point to a 12,250-foot pass where on July 6, 1907, there were patches of snow on the shaded spots of the mountain side, and where, on the night of that day, there was a considerable fall of snow. In two hours travelling from that pass, or two and a half from the harvesting scene is the dense tropical foliage, the heavy rainfall and great humidity of the wet eastern valleys.

The upland which is at this place the boundary between the plateau basin region of dryness and the valley region of tropical rains, is not the eastern limit of the Cordillera; it is well within that limit. Two and a half days of hard traveling from this point toward the northeast are required to bring one to the eastern front of the Andes which here ranges in elevation from 1,000 to 4,000 feet and is broken up by wide deep valleys cut well toward the level of the piedmont plains here fronting the mountains. Not only is this immediate front bountifully watered but the trades rise over all that part of the eastern plateau below 10,000 feet and give it as well a copious rainfall. In addition, the winds blow up all the deep, unobstructed valleys to their headwater passes; and the passes, not the eastern scarp of the upland, constitute the wind barrier in whose shadow the dry basins and the inter-plateau valleys occur. The upper and western limit of the trade wind rains of the Andes is therefore an irregular line lying within the plateau and coinciding in trend and altitude with the frost line of obstructing elevations. The only exception to this rule is found in the case of valleys whose irregular courses are typified by the Rio Grande. This stream drains the Cochabamba basin first southwestward, then describes a great curve to southward and eastward, finally turning north to the Mamoré and thus its waters eventually reach the Amazon. The floor of the Cochabamba basin is but 8,500 feet above sea level but the trade winds and their rains do not blow here from down valley because of the obstructions offered by the irregular and in places exceedingly narrow course of the valley. The winds of the basin are the trades, but these have come from the southeast over mountain barriers. They therefore descend to the lower elevations as dry and drying winds.

In consequence of this up-valley movement of the trades, the valley climate, characterized by great precipitation, high relative humidity and cloudiness, and high temperatures, is characteristically found but a few miles from the arid, irrigated, inter-plateau valleys and basins. Every aspect of the domestic structures and human affairs of the two adjacent regions is in similar contrast. For the flat roof and thick walls of the plateau dweller, admirable for the cold they serve to exclude, one sees wall-less or nearly wall-less huts whose long, sloping, thatched roofs in this wet climate are a very practical and essential element of the architecture. Instead of using stone or mud bunks or floors for sleeping quarters, as does the plateau dweller, the valley inhabitant sleeps under the roof, on the second floor so to speak, and above the wet earth. Within a few hours' ride of each other two types of farms may be seen: the one is irrigated carefully and the crop yield is only from the seed planted thereon and the owner uses straw and desert bushes for fuel; the other is literally chopped out of a sub-tropical forest and grows up quickly to weeds and underbrush. In but a day one may ride from portions of an arid plateau so cold that barley will not grow, to a tropical valley where bananas, oranges, and coca plantations abound.

It very naturally follows that a commercial interchange should originate involving the contrasted products of these regions so distinct climatically, yet such a short distance apart. This interchange is brought about in many ways, but perhaps one of the most instructive is that witnessed 30 miles southeast of Cochabamba on the pampa de Cliza.

Cliza is one of a group of towns lying upon the Cliza pampa, a semi-arid flat, twenty miles in diameter. It is watered by several streams that descend from the surrounding uplands. One of them is the Cliza river. It inundates its lower valley and terminates in a shallow depression. At times of unusually high water it discharges into the Arani, the draining stream of the basin and itself a tributary of the Rio Grande which flows past Cochabamba. Because of these natural inundations and the water supplied by irrigation works in the valleys as well as by the light rains, the inhabitants are able to farm the basin intensively. The elevation is about 9,000 feet and as frosts occur the delicate fruits of the tropics are excluded. It is a grazing and barley and wheat-raising section and every sort of vegetable is produced.

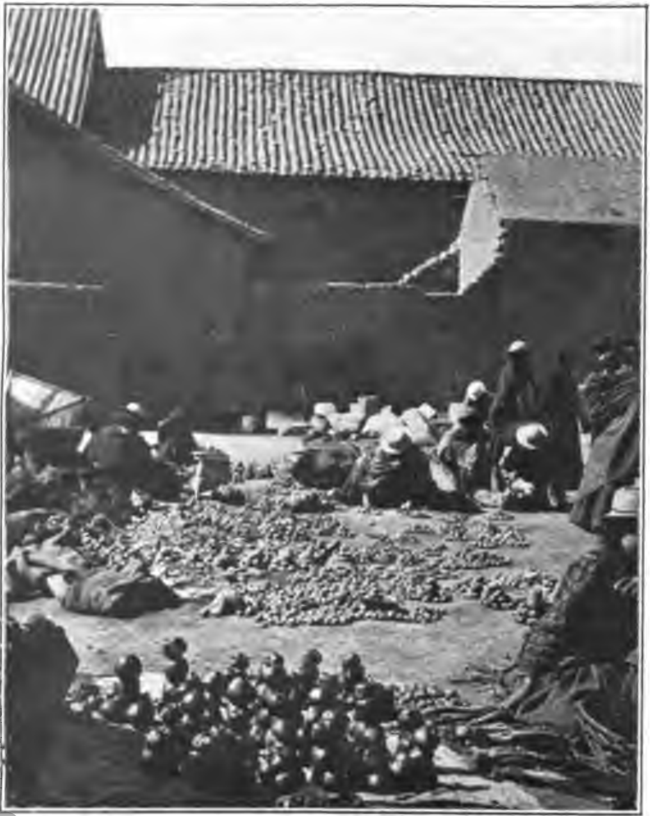
The Cliza market held each Sunday throughout the year calls together from the surrounding country an incredibly great variety and amount of products and people. Here foregather each week several thousands of farmers, artisans, merchants, ranchmen, not to mention a goodly number of cut-throats, thieves, and beggars.

The farmers of Mizque and the adjacent tropical valleys bring oranges, bananas, peanuts, leaf tobacco, coca and skins. These products are carried by donkey and mule and on the backs of Indians up over the passes in the cerros, or low mountains, which like a wall surround the pampa de Cliza. In less than twenty-four hours the tropical products of these eastern valleys are carried from tropical valleys over cold desert mountains and delivered to the sunny Cliza pampa ready for the Sunday market. The distance is only from thirty to seventy miles and for the lesser distances the start is made on Saturday and all of Saturday night the caravans come streaming into the village with products for the morning's sale.

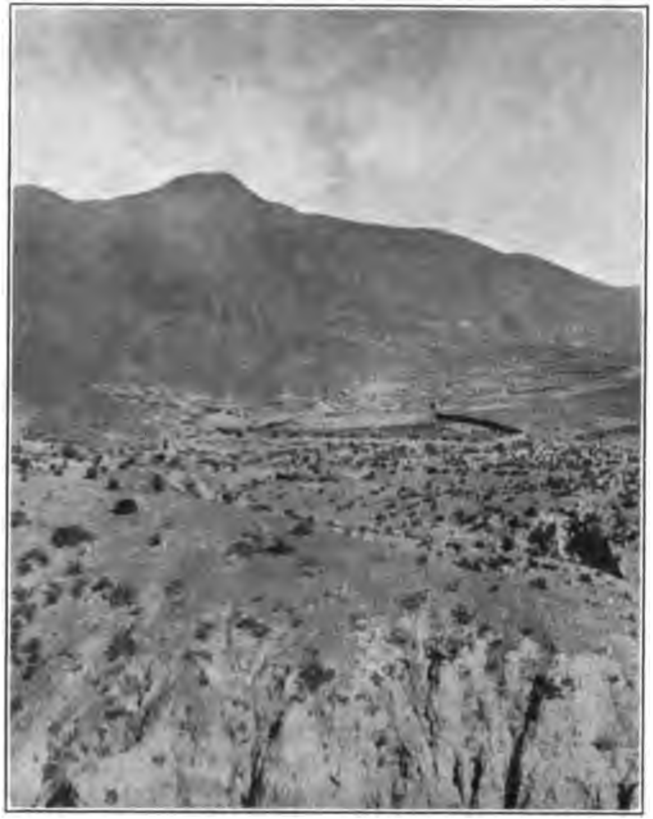
Rice is brought from Santa Cruz, an isolated city out on the piedmont plains east of the mountains, twelve days' journey from Cliza. From the plains also comes sugar cane, eaten as a delicacy and boiled for a syrup used in making several native dishes; coloring matter from tropical plants for shawls and clothes and blankets; skins of cattle and sheep which graze out in the scrub of the northern Gran Chaco; chocolate from far down the Mamoré brought hither laboriously by caravans and on mule back, a journey of a month and a half; carved chicha dishes made of the hollow tutuma fruit, and braided lashes and saddle equipments of bullhide.

The sight of all the products gathered here for a single day grips the imagination powerfully. This Sunday market at Cliza, is one of the most interesting phases of commercial life in Bolivia: Potosi sends a small amount of silver; Sucre, horses and mules; and the Yungas country, products similar to those already mentioned as brought from the tropical plains. The larger part of the products are of course from the pampa de Cliza itself, which produces an abundance of wheat, barley, corn, cattle, burros, mules, and vegetables and fruits of all sorts—onions, potatoes, lettuce, peppers, melons and coca—and is the great center for chicha, the national drink of Bolivia.

Cliza itself has no large stores, only little shops where small supplies of merchandise and food may be obtained, hence the merchandise for the Sunday market is brought in from Cochabamba ten leageus west of Cliza. The Cochabamba merchants bring over to the market every class of goods bought and sold in Cochabamba or in modern stores anywhere—candles, hoes and spades, horseshoes, sickles, glass and spurs, rope, hats, canned goods such as sardines and condensed milk, bread, thread, pins, needles, lace, etc., etc. One may even see oil in 25-pound tins sold here—chiefly oil that is brought down from the California fields and shipped by rail *via* Antofagasta or Mollendo and by caravan from Oruro to Cliza. These various sorts of marchandise are, like the valley products, transported to market every Saturday, and on Saturday night troop after troop of donkeys and mules arrive in Cliza laden with boxes and bales. On Monday they return with products exchanged for merchandise or with unsold goods required again in the stores at Cochabamba. Usually the merchant keeps a large assortment of goods in stock in the house of some friend at Cliza or in a rough



Display of Vegetables at the La Paz Market. Potatoes, in a score of varieties, onions, pumpkins, squash, peppers, and all kinds of native fruits are sold here. The articles come from the plateau in part but are chiefly from the eastern valleys, being brought hither by caravans which supply the plateau towns with the temperate and tropical zones products which can not be produced upon the cold plateau.



Villages Located upon Alluvial Fans near Cochabamba. The loose and fertile soil is favorable for agriculture and thin streams from the mountains supply enough water for irrigation. Elsewhere the mountains and plateau are useless save where springs occur or where there is sufficient pasturage for the semi-nomadic flocks.

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warehouse there and simply replenishes this by small weekly cargoes from Cochabamba. In short, we have manufactured goods brought into two regions which have a surplus of field products.

The transformation of the small town of Cliza, which the Sunday market effects, is one of the most curious and instructive sights in Bolivia. On Saturday afternoon, the day before the fair, the plaza is well-nigh deserted—only a scant half-dozen venders are to be seen lazily squatting beside well-nigh empty baskets of fruit. At sunset, caravans with manufactured goods from Cochabamba come trooping in and the drivers at once begin unloading and distributing the cargo. Throughout the night carriers are bringing bales and boxes from warehouses and unpacking them at the direction of the owners, and by daylight the plaza is completely occupied by the canvas booths of the merchants. Every available bit of space is utilized—the walks, the benches, the streets, right up to the very doors of the houses. The central plaza, which is the largest, is used only for general merchandise, and fruits, meats and vegetables. The other products are vended in special places. In a certain street may be found sheepskins, sheep, and pigs; in another, whips, bridles and leather goods; a small plaza off the main one is the potato plaza, another is for wheat only; and in the cattle plaza on a terrace in the southern edge of the town are gathered several hundred head of cattle, burros, and mules.

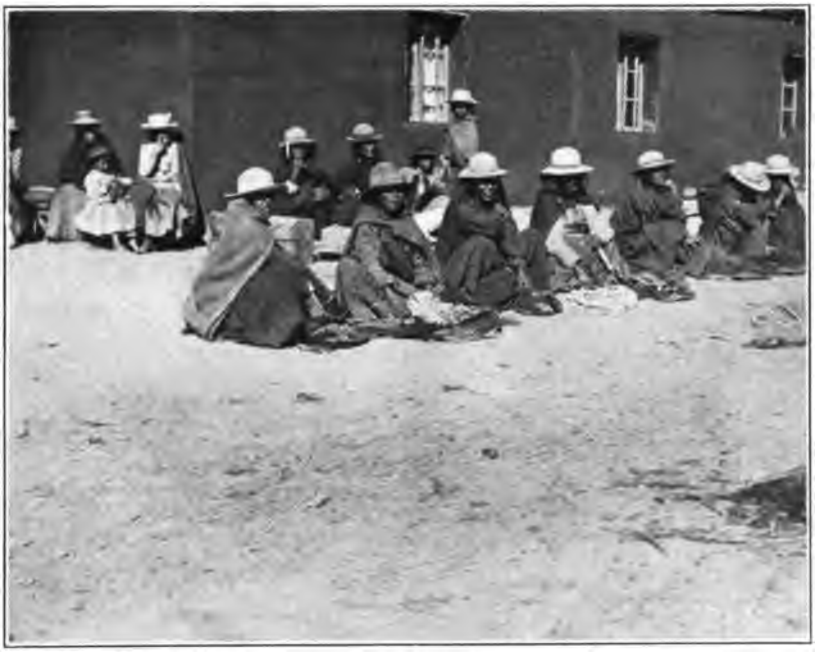
The crowded booths and streets make thieving easy and the merchants tie down their goods on the movable counters with rope, and watch their stock constantly. During the day there is an almost continuous stream of callers at the Intendencia, to complain of the loss of goods, to ask for a soldier to arrest some thief, or disputants who come to arbitrate their differences. The cases are all settled in an informal way except those which clearly involve criminality and these are left over until Monday. Great quantities of chicha, the national beverage, are consumed, to facilitate the transfer of goods, and as a consequence there are quarrels without end and even murders which are attended to during the week following.

The Intendente of Cliza, whose hospitality we enjoyed while there, jokingly turned one case over to me for settlement. The complainant was a cripple of somewhat reduced mentality whose anguish was expressed in the form of profuse perspiration and incoherent speech. The burden of his complaint, expressed in mixed Castillian and Quichua, was not clearly discernible. It appeared that once he possessed a certain object and now it was in another's hands and somehow his right in the transfer had been neglected. He wished a soldier to accomplish somebody's arrest. I ordered that he should should have not only one but two, and the assumed culprit, a tall and handsome Quichua girl, was haled into my presence forthwith, to be almost as speedily discharged!

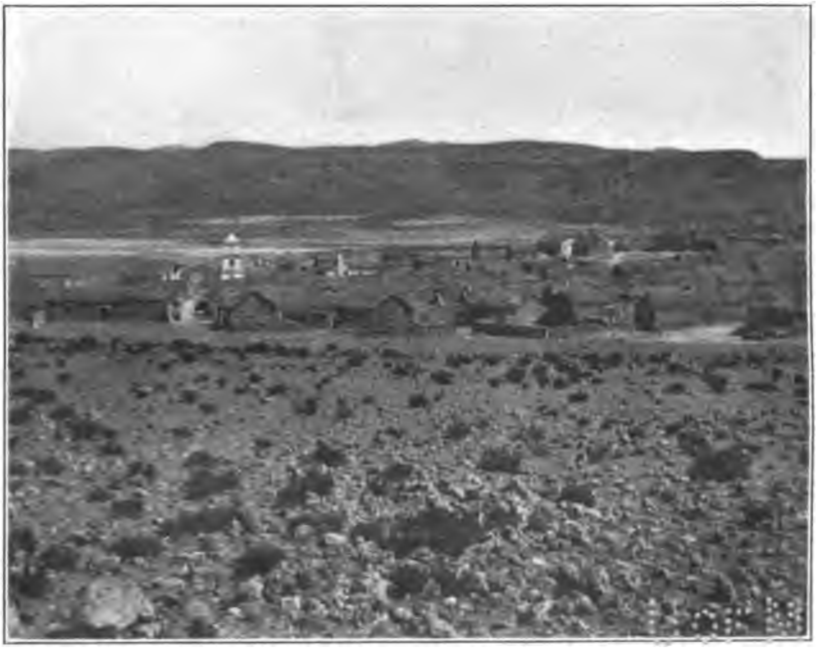
In the middle of the afternoon the crowd begins to diminish, and by dark the booths are down, the goods repacked for the return to Cochabamba or the tropical valleys, or for storage in warehouses, and the plaza is alight with fires from the waste paper and broken boxes. Early Monday morning the merchants' carriages go rattling out of Cliza and sleepy caravans straggle across the pampa for the long journey home.

A market like this, which engages the interest of thousands of people from all the surrounding districts and which has been continued weekly, without interruption for over seventy years, reflects the physical conditions which surround the people as well as their commericial needs and activities in a very clear and instructive manner. It is man, whose primary necessities and desires are very much alike the world over, supplementing incomplete nature and trying to soften the differences between a semi-arid but fertile plateau basin and a series of rich tropical valleys and lowlands with complementary products.

The town of Huynuni illustrates trade features similar to those at Cliza. It is twenty miles within the western edge of the eastern plateau near the headwaters of a stream tributary to Lake Poopó. The elevation of the town is 13,000 feet and only barley and potatoes, llamas and sheep can be produced. The vegetables and other desired foods are imported from the valley of Llurivayi and others, thirty or forty leagues east of Huynuni and at an elevation of 8,000–10,000 feet. It requires the greater part of a week to make the journey. There are regular market days, sometimes once, sometimes twice a week, in which the local venders, in little booths, dispose of the cargoes. Purchases may be made on other days but the stuff is apt to be inferior. One finds the market stocked with every variety of product—cabbages, lettuce, carrots, potatoes, oranges, many kinds of seeds, onions, salt, sugar, apples, peas,



Women Selling Fruits, Vegetables, and Bread to Travelers on the Antofagasta-Bolivia Railway.



The Village of Llica, Bolivia. This is one of the larger towns on the remote western border of the country. The isolated character is well shown in the scarcity of foreigners and people of Spanish descent and in the almost lifeless condition of trade.

peanuts, meats, etc. Anteguera, a mining town seven leagues southwest of Huynuni and numerous other mining centers in the plateau are supplied in the same way from the eastern valleys.

In every arid land the cyclic climatic changes common to all climates gravely affect the food supply and the cost of food commodities. In years of increased rainfall these are very cheap, in years of normal rainfall the price is moderate, in years of drought they are very dear, even unobtainable. While we are familiar with both the sociological and economic effects of such dry periods even in humid regions the effects are neither so widespread nor so extreme as in arid or semi-arid regions where the margin of adjustment is always small. There, ill-success may mean, as in the extreme climates of Arctic regions, not only inconvenience but widespread disaster.

This principle is illustrated by the conditions prevailing on the plateau of Bolivia in the vicinity of Huynuni, about 1901–1902. There then began a series of unusually dry years which continued until 1906. In the dry years the production of farm products fell off greatly and the price rose to an unprecedented height. During the same period there was a rapid development of the mines and this called in laborers from the fields and ranches thus increasing the number of food consumers who were not also food producers. The result may be illustrated by the prices of a number of commodities in 1900 just before the dry period set in, in 1906, at the climax of the period, and in 1907, a prosperous year of recurring heavier rainfall.[8]

	1900.	1906.	1907.
Green barley (per quintal of 101.42 lbs.)...	$ .80	$8.50–$9.00	$4.50–$5.00
Grain barley (per quintal)	1.20	$12.00	$7.00
Potatoes (per carga of 137 lbs.).........	7.50	30.00	14.00
Cabbage (per head)		1.20	.20

Note: Carrots, vegetable marrow, etc., are now purchased at about one third the price of the driest period. The climax was reached in 1906. The figures are in Bolivian currency and should be divided by 2½ to transform them into United States currency.

One of the most noteworthy facts in the geography of Peru and

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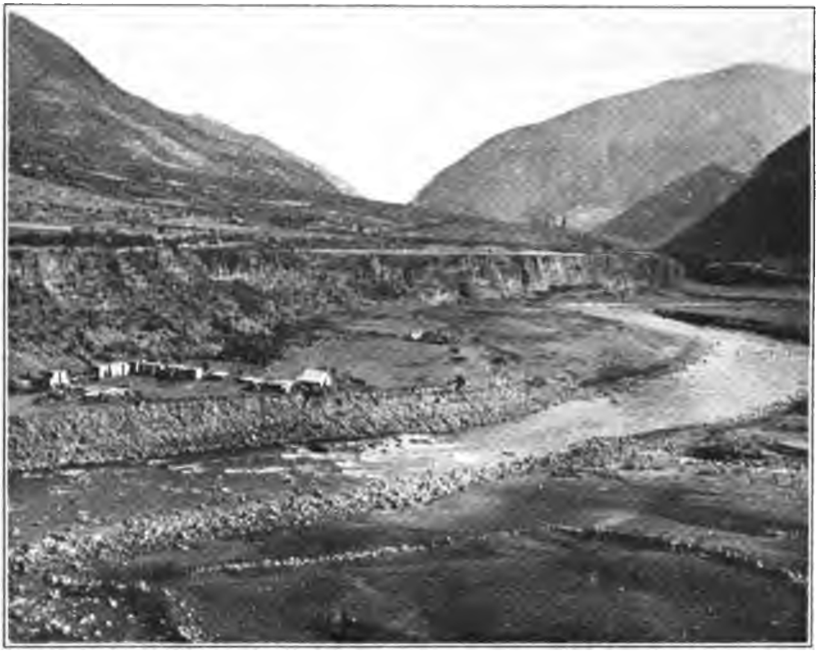
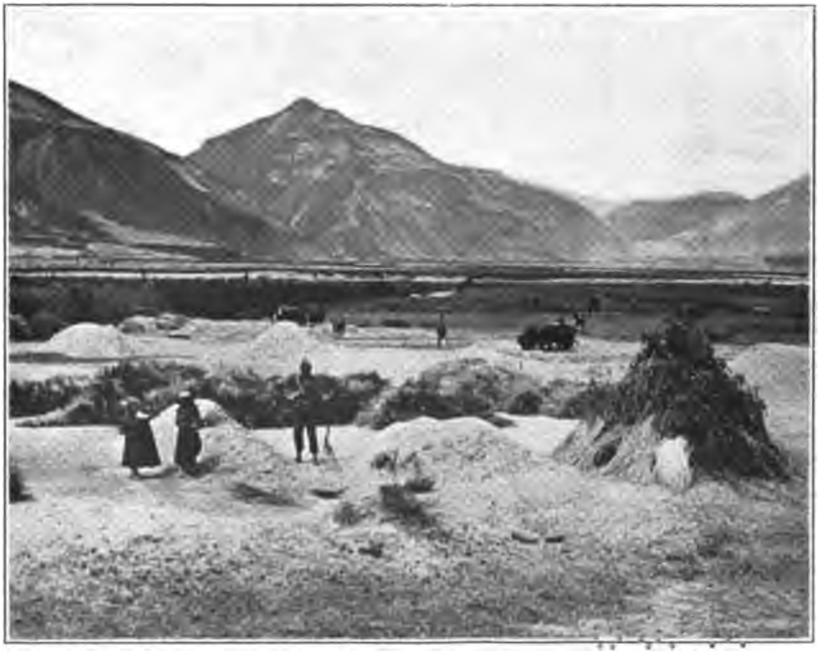
[8] Data from Ricardo Trewellah, manager of the Huynuni Tin Mines, Huynuni, Bolivia.

Bolivia is the relatively slight displacement of the Indian inhabitant with respect to his environment which has been effected by the white population. The wars of conquest were waged, the revolutions have come and gone, the industrial development of the region is in some section beginning, in others far advanced, but the agricultural Indian of Atahualpa's day is the type of the Indian inhabitant of the twentieth century. For all the territory from the Gulf of Guayaquil to the desert of Atacama in Chile and from the Cordillera Real to the western coast this fact is in general true. That this should be the net result of all the conflicting political and martial influences of the past four centuries is expectable only when one considers first of all that the Indians were agricultural—rooted to the soil; and second that that agriculture was well perfected by past centuries of clever trial. No more enduring guarantee of occupation could be found than this. In spite of the acquisition of white men's diseases and the ravages of the liquor habit, it saved the Quichua and Aymara tribes of the highland from the bitter fate of the hunting tribes of the south, the Yaghans, Onas, and Tehuelches of Patagonia and Tierra del Fuego.

A contributary cause not to be overlooked is the influence of the narrow limits of other than agricultural resources. The only wild game worthy of the name are the vicuña and guanaco, first cousins of the llama and alpaca. These roam the mountains and plateaus in limited numbers, going well up to the snowline in summer and in winter coming down to the basins and valleys of the plateau. They are a distinct though small supplemental food resource even to this day. They could never support more than a trifling fraction of the population and would be a most uncertain resource because of their extreme wariness. Nor can fishing ever be developed to a considerable industry. Lake Titicaca and its outlet stream, the Desaguadero, are the only inhabitable waters of the whole plateau region. The fish found in these waters are very small but are utilized to some extent in supplying the La Paz market and for local consumption. This resource has developed the most unique population group on the plateau, the declining Uros tribe of Indians, the only known plateau group in the purely fishing and hunting stage of development. The Uros live partly on floating structures in the reed swamps of the Desaguadero, fish in straw boats, hunt the birds that nest in the reeds, are small and timid, and have excited the



A Highly Cultivated Alluvial Fan in the Urubamba Valley on the Way to Cuzco, Peru. These are the choice agricultural spots of the highland dweller of Bolivia and Peru.



Farming Scene in the Urubamba Valley on the Way to Cuzco, Peru. Note the farms on the flat upper slopes of the mountains. The oxen in the view are treading out the barley which is then winnowed in the wind and sacked.

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attention of students ever since the days of Herrara.[9] Elsewhere, the almost complete absence, upon this bleak and unforested plateau, of game and of edible varieties of natural fruit or of food products found in forested regions, has kept the population firmly fixed in their ancient habits and locations.

The only important transformation of the relation of the Indian to his earlier environment has been effected by the whites in connection with the mining development of the region. The Indian was formerly persuaded to work in the mines only by great effort because of the loathing for all mining work engendered by the cruelties of the early Spanish. Now he is employed with his own consent, is well paid, and may discontinue relations with his employer at will. This brings the Indians together in compacter villages, creates a sort of skilled labor where before there was often in the vicinity of the mine only the rudest husbandry, and focuses group needs in a much more comprehensible manner. As a consequence the miners often go out on a strike for higher wages or the correction of alleged abuses quite in the manner of industrial units in more enlightened lands. The miner also becomes much more easy of manipulation where this stage has been reached and these mining groups, if disaffected, may, as they actually have in the past, be armed by revolutionary parties and hold, by their influence on the surrounding agricultural towns, the balance of power at a critical moment. Although he is meek and submissive and stolid enough when there is no opportunity for revenge, he recalls every injury when a chance is offered for retaliation. During times of political unrest he is sometimes aggressively active in the revolutionary movement which is not so much an opportunity to right a national as a local wrong. On the frontier and in isolated localities he thus first turns loose on the exacting priest, as at Llica in the last revolution, and later takes up the more general wrongs of the time and place.

Two of the best indications of the firm grasp the agricultural inhabitant has upon the country are, first, the completeness with which the alluvial fans are occupied and second, the peculiar utilization of a set of upper slopes of pronounced flatness which terminate well above the valley floors. Illustrations of the complete occupancy of alluvial fans are to be gathered all the way from the southern frontier of Bolivia to northern Peru. It is the most conspicuous and general distributional fact of the whole region. Fig. 12 shows this relation of alluvial fan and town. No clearer illustration could be provided of the well-watered, terraced, thickly populated alluvial fan, with the scattered vegetation of the surrounding mountains suggesting the stock range that supplements the resources of the town. The site is excellent not only because of the deep, rich alluvium washed from the adjacent uplands but also for the water supply which the fan itself indicates, and for the regular grades that make irrigation works easy of construction. The photograph is a composite of all the elements of the farm scenes of an entire geographic province.

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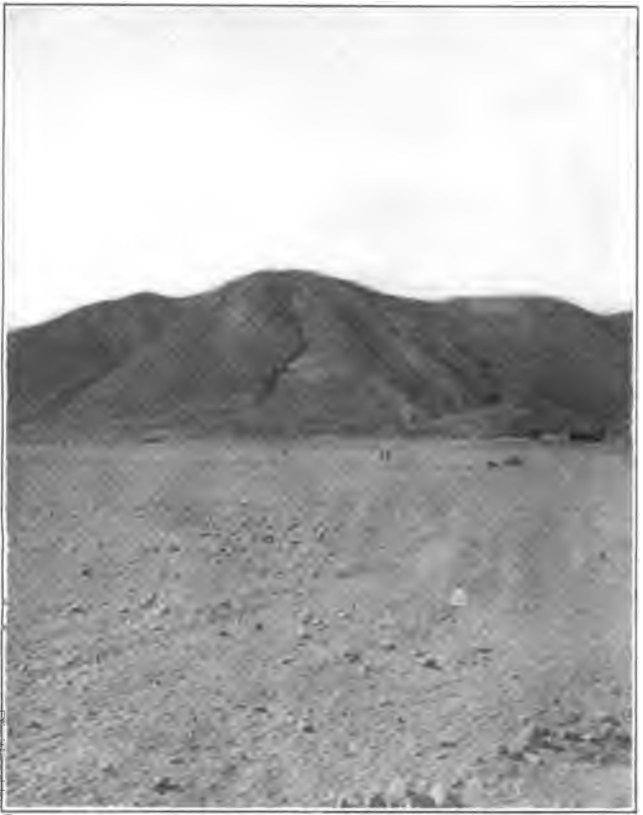
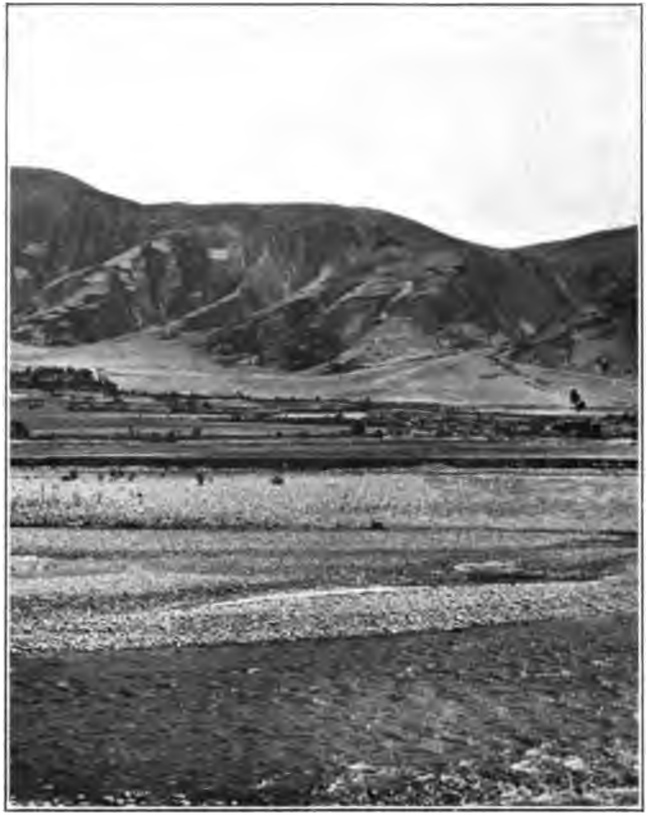
[9] "Billinghurst on the Desaguadero," *Geog. Record, Proc. Royal Geog. Soc.*, vol. 4, 1881, p. 647.

One sees this sort of thing beautifully represented on the coach road from Oruro to Cochabamba. At the 14,000-foot pass east of Pretoria Station only a most desolate landscape appears, with low scattered bushes and bleak wind-swept highlands. Crossing the pass one next descends the valley where at about 12,000 feet and in the well-watered patches, barley fields of some consequence appear. At one spot we observed a shaded spring, frozen solid, and just above it on a sunny slope a patch of growing barley. A greater abundance of natural vegetation is noted here with a corresponding increase in the number and size of the flocks of llamas and sheep. At 11,000 feet occur a few potato fields and lower still in succession one sees blossoming orchards and vineyards, thrifty vegetable gardens, masses of violets, hyacinths, sweet peas, and laden orange trees. Throughout the whole descent one sees at every turn the two typical locations for barley fields: the alluvial fans tributary to the main valley and the flatter upper slopes high above the valley floor. The gradation in the size of the villages is as regular and certain as the downstream increase in the sizes of the alluvial fans. All the fans are now being dissected and their gently-sloping upper surfaces are therefore set well above the level of the floors in the main valley. The typical relation is that shown in Fig. 13. The physiographic changes whereby this relation has been established have been extremely beneficent, for they thoroughly assure the safety of the towns with respect to overflow. In most cases the dissection has not been so great but that with a moderate outlay of time irrigating ditches can easily be constructed from the head of



Terraces in Ravines Back of the Town of Challapata, Bolivia. So precious is the water that it is not allowed to run out upon the plain of loose gravels and sands in the foreground but is led out upon small terraces near the point of origin and thus husbanded. Barley is the chief product of these terraces. It is used for fodder for beasts and as a staple article of food among the natives.



Barley Fields on the Flat Upper Slopes of the Urubamba Valley of Peru. Recent uplift and dissection of the region have destroyed much of the arable land and will in time thoroughly dissect the flat-topped spurs. This use of a situation so difficult to reach is characteristic of the people of the central Andes who have sought out the best land regardless of its position.

the fan. These descend along the base of the main steep slope limiting the sides of the fan and by gentler grades than the natural stream divert upon the flat surface the desired quantity of water. Frequently one may see a second or a third fan built out of the debris of the highest one, this likewise irrigated. In the latter case irrigation is usually from the main stream. The intake is then located a few hundred yards up valley and the diverting canal runs neatly about the irregularities (the spurs) of the valley sides and always with lesser grade than the valley floor, to arrive at last at the upper part of the lower fan. From this point distributaries continue to flow over the lower cultivated slopes of the fan whence the discharge rejoins the river. In a valley of steep grade such as this one the tributary fans have but short slopes upstream with respect to the main valley. The long and cultivated slopes are down stream. This physiographic condition necessitates the construction of a tunnel through the head of the alluvial fan to reach the cultivated or down-stream side of it. This is first built as a deep open cut and then covered over. The main canal is often built up as a viaduct of 20 feet in height; at other places it is neatly chiseled out of the rocky slope or tunneled for short distances through sharp, narrow spurs. At a few localities water wheels and mills have been installed, the water being used for this purpose when not demanded for irrigation.

While this location upon an alluvial fan enjoys certain advantages, as already enumerated, it has the disadvantage of liability to slow destruction by the sidewise cutting of the main river when in flood. The outer edge of the fan is then consumed and if the process is repeated the whole fan may be destroyed. Such marginal dissection is inevitable sooner or later in every case, by virtue of the systematic development of the curves of the main stream. While the loss to the owners in any given case is absolute, the loss to the valley as a whole is only relative as in those localities where the river has ceased to cut for many years the fans are steadily recovering their former dimensions by riverward growth. The total area of fan surface in the valley is therefore practically constant. All stages in the progressive destruction of the fans may be noted, from fans whose outer edges are so faintly cut that well-built stone walls of recent construction protect the fields behind them from danger, to those so nearly cut away that only the merest patches now remain. In one locality we saw where half of a building has been dropped into the stream below while the other half almost tottered on the verge of the bluff and the farm site had been wholly abandoned by the owner.

The location of farm sites upon the flat upper slopes is represented by Fig. 14. From an earlier condition of maturity in which the valley sides descended by regular though pronounced grades to the valley floors of that period the landscape has been altered to its present form by stream dissection occasioned by regional uplift. For this cause the main streams have cut far below their older level and have widened their valleys to the point represented by the steep marginal slopes of Fig. 14. The valley widening has not however been continued to such an extent that the former flat grades have been wholly destroyed. They are still visible from all points in the region and actually dominate every view from a commanding point. The tributary streams cascade over the conspicuous shoulder which marks the change in grade from the flat upper to the precipitous lower and younger slope. The difference in elevation between the fan and flood plain surfaces and the flat upper slopes is only trifling near the head of the valley but increases downstream to several thousand feet.

Up this several-thousand-foot scarp the Indian farmer climbs with his seed barley, scratches the ground with an iron hoe wherever a sag, a spring, a seepage line or belt, or an exceptionally flat area occurs, sows his grain, and in the harvest season laboriously descends with the product. From vegetable gardens and orange groves wholly without frost from one year to another one may occasionally look up several thousand feet to waving fields of barley in locations marked by frost several months in the year. The upper situations are again shown in relation to the lower in Fig. 15, from the Urubamba valley in southern Peru, and are indicative of the wide occurrence of this physiographic control.

The care displayed by the farmer in the utilization of his water supply is well illustrated at Challapata, sixty miles south of Oruro at the western foot of the eastern plateau. The field relations as shown in Fig. 16, are those of small streams (with meagre supplies of moisture) to a piedmont slope of loose detritus which quickly absorbs the feeding streams. By virtue of the porosity of this material it is imprudent to farm the lower plain at this point except for a single crop after the rainy season when the loss of water in the porous material is less keenly felt. The permanent fields are well up the hill slopes near the sources of hillside streams where there is the minimum loss of water in applying it to the land. The neat terraces at this location are prominent marks of the care which the farmer has bestowed upon his craftily located barley farm.

Of the many interesting responses to physical condition among the plateau inhabitants not the least important is that due to the distribution of the meagre rains. The region south of Oruro along the line of the Antofagasta-Oruro railway is one of the best illustrations in point. It may be understood by a glance at the physical conditions that obtain there. It has already been noted that that section of the eastern plateau which lies between La Paz and the Argentine frontier is in general highest near the western border of the plateau, or on the slopes of the eastward looking valleys. Some rain from this source therefore falls quite up to the culminating western portion of the plateau. Like the rains of the interior basin these are chiefly in the form of summer afternoon thunder storms and winter afternoon snow squalls. Occasionally, but not for long, the whole sky is overcast and very light showers of wide distribution may occur, or a thin blanket of snow which is quickly melted or ablated in the succeeding sunshine. The interior basin is watered from these sources distinctly better in the eastern portions along the base of the plateau than on the western or central portions. The eastern slopes of the western plateau and mountains again receive a perceptibly increased amount of rain and have a line of scattered towns in consequence, such as Llica, Canquilla, Sitani, Cueva Negra and Chilata. But the densest occupation of the land is along the better watered eastern portion of the basin. The control over the distribution of the population of this section is, however, not alone the heavier rains but also the confluent alluvial fans that make a continuous piedmont slope from Oruro 150 miles south to and beyond Uyuni. Upon this fringe of alluvium is gathered more than 50 per cent. of the whole agricultural population of the alti-plano of Bolivia outside the department of La Paz. The railway from Antofagasta serves and encourages them all, Challapata, Machacamarca, Poopó, Huari, Separayo and many others. The mining development has been chiefly in this margin of the eastern highland; and the agricultural towns, by the sale of barley, vegetables, meats, blankets and the like to the mining towns, have been stimulated to develop their agricultural lands to a marked degree.

A final cause which must not be overlooked in the study of these prosperous towns is the relatively greater constancy of the water supply on the whole piedmont strip due to the fact that the westward flowing streams which drain the western margin of the upland draw their supply from the highest portion of the plateau. The regime of the springs at their sources is therefore less variable than elsewhere within the plateau at lesser elevations and the streams they create supply water throughout the year, though in notably greater volumes in spring, when to the heavier rains of that season are added contributions from the melting or light winter snows in the highest portions.

Here one finds often in short distances neat cross-sections of the life of these highland people. In the plateau, as at Huynuni, are a group of tin mines at the head of a valley discharging westward to the interior basin; the valley itself is farmed at favorable localities and at its mouth is a widespreading alluvial fan that reaches far out toward the center of the interior basin; the head and intermediate parts of the fan are farmed, and marked by prosperous villages and gardens; the outer edge, more poorly watered, is used for grazing and is dotted here and there with the huts and corrals of the llama herdsmen; while beyond this, to the southwest, are the white, salt-incrusted surfaces of the salars adjacent to Lake Poopó. The mine on the mountain slopes, the village clustered about the concentrating works below, the railroad out on the pampa, and slow-moving caravans of llamas, bearing barley, merchandise, and salt, complete the view. From a single position one may thus mark the whole range of the highland dweller's activities, the complete circle of industrial and agricultural Bolivia.

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PUBLISHED QUARTERLY BY THE GEOGRAPHICAL SOCIETY OF PHILADELPHIA, PA.
41 North Queen St., Lancaster, Pa., and 400 Witherspoon Building, Philadelphia, Pa.
$2.50 PER YEAR *SINGLE COPY, 75 CENTS*

Entered as second class matter May 4, 1908, at the Post Office at Lancaster, Pa., under the act of July 16, 1904.

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PRICE

Single number, 75 cents General subscription, $2.50 per year
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